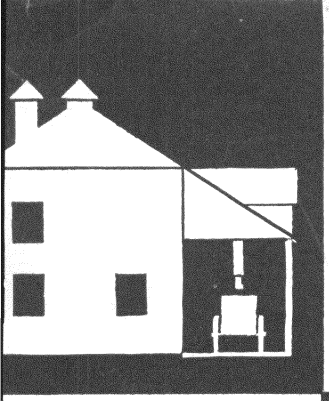
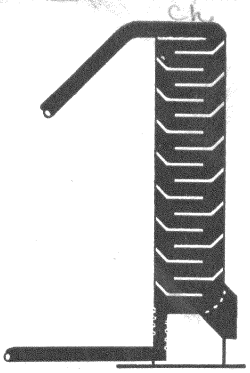
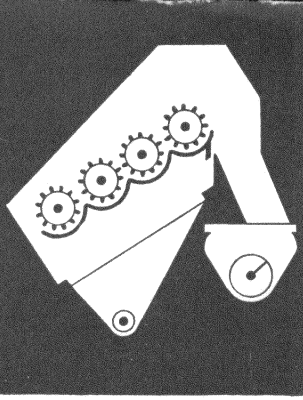
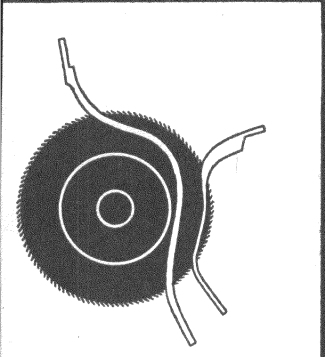
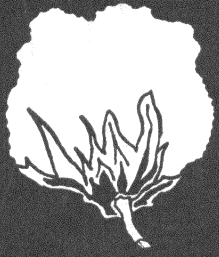
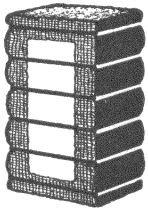
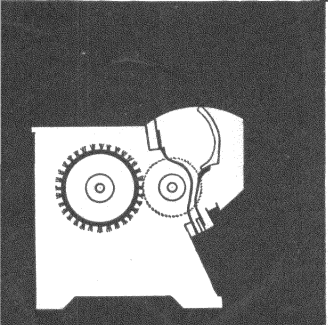
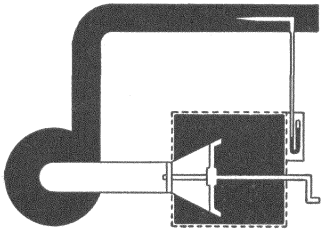
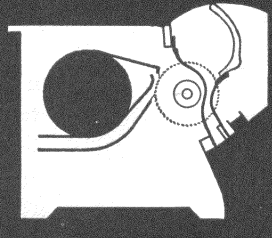

MODERNIZING COTTON GINS

FARMERS' BULLETIN
No. 1802 sl. rev. Feb. 1939

U.S. DEPARTMENT OF AGRICULTURE

COTTON GINNING is undergoing improvements which make it possible to reduce costs, better the quality of the ginned lint, and increase its market value. Both the grower and the ginner are benefited, directly or indirectly, by each advance in ginning practices and each improvement in equipment. The following are the most important features of a modern cotton gin:

A fireproof single-story building.
Adequate illumination and ventilation.
Cotton-drying equipment.
Cleaners and extractors to serve the regional needs.
All-steel cotton handling and ginning machinery.
Ball-bearing or roller-bearing mechanisms.
Improved piping and fan installations.
Pure-seed protection by belts and other means.
Seed scales and platform bale scales.
Metal seed bins for loading wagons or trucks.
All-steel press, with mechanical tramper and hydraulic ram.
Ample shelter and storage facilities for seed cotton and seed.
Attractive premises.

Washington, D. C.

Issued July 1938
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MODERNIZING COTTON GINS

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CONTENTS

INTRODUCTION

IMPROVED COTTON-GINNING PRACTICES and better ginning establishments improve the quality of ginned lint, aid in keeping planting seed pure, and tend to increase profit. Many public ginners, as well as farmer-ginners, would modernize their establishments in whole or in part if they were assured that they were taking the right steps and that they would be actually following the recommendations of State and Federal agencies working toward these improvements.

In the case of existing cotton-ginning establishments it is frequently a question whether to remodel or rebuild completely. This question can best be answered by asking other questions. Is the present equipment still serviceable and in good condition? If so, is it adequate for the present requirements of conditioning, cleaning, and extracting? Will the cost of modernization of either equipment or buildings be less by remodeling than by entire replacement? Which will attain the main objectives with regard to both public and private interest? Is the present or proposed establishment economical in operating the equipment for cotton handling, ginning, and disposal of products?

This bulletin is intended to help ginners and farmer-ginners to answer these questions and to plan according to the needs of their own individual circumstances and those of their communities.

APPRAISAL OF EXISTING GINS

Consideration must be given to the location of the gin on the farm or in the community. Frequently conditions have so changed that gins are now in very poor locations. Accessibility to roads and trans-

portation facilities and the proximity to competitors may have changed, in a large measure, since the original establishment of the ginning plant so as to affect materially the present value of the plant in many instances.

A simple sketch of the property showing the relative positions of the several buildings and accompanied by marginal notes describing the territory served, the number of bales of cotton ginned over an average period, the increase or decrease in cotton acreage in the community, and other influencing factors, will be of assistance in making a complete appraisal.

The inspection of the buildings on the property should be made only by a person experienced in building, and definite information should be obtained regarding the condition of each building, the feasibility of moving it to a new position on the lot, and the adequacy of the plant for use under present conditions. From this information a builder can readily provide estimates covering the cost of additions, alterations, and repairs. If a new all-steel, 22-foot plate-height fireproof ginning building is to replace a wooden building, a preliminary estimate of $2 per square foot of floor area may be safely used.

Cost of equipment and machinery may be most satisfactorily obtained directly from the manufacturers, because all items entering into the purchase, shipment, and erection are available.

ELEMENTS OF MODERN GINS

A modern cotton-gin plant is fireproof, conveniently arranged inside and outside, and properly lighted and ventilated, either artificially or naturally. It has cleaning or extracting equipment suited to the needs of the community, and the gin stands are equipped with huller fronts for further cleaning of the cotton. Provision is made for artifically drying green, damp, or wet cotton. The saw shafts of the gin stands are preferably directly connected for driving, and there is a minimum of shafting and belting. Bearings are of the antifriction type rather than of the old babbitt design. Cotton piping and fans are of a size that contribute to economy in power consumption.

Seed is elevated for disposal by sturdy and efficient elevators instead of by wooden bucket elevators that have given much trouble because of the slipping of the vertical driving belt and the misaligning of the elevator due to building shifts. Seed is more economically moved by a conveyor than by a blowing system. Such conveyors should be operated in steel troughs equipped with steel covers rather than in wood troughs having wooden covers and wooden cover strips. Various means have been devised for keeping seed pure.

Power-transmitting equipment for screw conveyors now includes high-speed countershafts, antifriction bearings, high-speed silent chains and roller chains, and gear reducers instead of the old-style heavy, long line shafts, babbitted bearings, belt drives, rope drives, gears, and countershafts that were formerly operated at low speeds with no protection. Seed scales are becoming standard equipment for accurately weighing seed purchased from the farmer, and a modern gin has a convenient waterproof hopper that drops the seed into the farmer's wagon.

Mechanical means for disposing of foreign matter at some distance from the plant are desirable. Modern gins also have adequate

facilities for storage of bales where they will be protected against weather and fire. Shelter sheds protect wagonloads of cotton against rain. A seed-cotton storage house is arranged to provide for economically unloading seed cotton from wagons for storage and for transferring it from storage to the gin.

ARRANGEMENT OF BUILDINGS AND GROUNDS

Among the factors to consider in deciding upon the best arrangement of the ginning buildings are the shape and size of the lot, the location of entrances and exits with respect to the public highways, the position of railroad tracks, and the method of handling wagon and truck traffic through the entrances and exits of the lot.

Figure 1 shows three good lot arrangements. The shape and size of the lot and the location of the gin with reference to roads and rail-

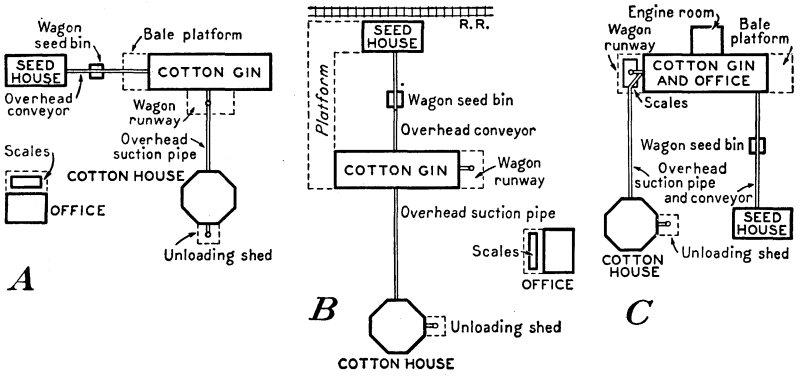

FIGURE 1.— Arrangements of buildings of modern cotton gins: *A*, Operations from a special office on the grounds; *B*, office may be either separate or within the ginning building; *C*, third most popular arrangement for position of buildings.

roads may prevent the adoption of ideal arrangements, so no hard and fast rule can be laid down.

No shelter sheds or other accessories have been indicated in the foregoing lay-outs for positions of buildings because the number and location of such accessories are largely dependent upon local conditions and practices. Different communities handle cotton in different ways, although the simplest method of weighing in general use is that in which the wagon scale is either in front of the office or beneath the suction pipe of the gin.

BUILDING CONSTRUCTION FOR GINS

Fireproof gin buildings are highly desirable, and if they cannot be of masonry or all metal, they should be of heavy, mill-type timber coated with fire-resistant materials. Good illumination and ample headroom are necessary. Figure 2 shows cross sections and plans of gin buildings with desirable dimensions. Double-battery outfits require widths of 40 feet or more, and all installations should have at least 16 feet between the floor and roof plate. The length of the building should be coordinated with the number of gin stands. Straight-line roofs are desirable, but offset ones are frequently employed in one-and-one-half-story gins to obtain ample headroom over the press platform.

In new all-steel buildings, full-length overhung wagon sheds and runways are favored because there are no posts to be damaged by careless driving or accident. This necessitates strengthening certain parts of the building for ample support. Such construction is particularly desirable on city lots and other restricted spaces if the additional cost is not too great.

The roofs of modern gin buildings may be flat, pitched, or curved, but, above all, they should be fireproof and readily accessible for cleaning and repair. Many types of trusses are in use, the best forms being of structural steel or heavy timber framed so that block and tackle loads may be supported from the lower chords. By selecting the roof

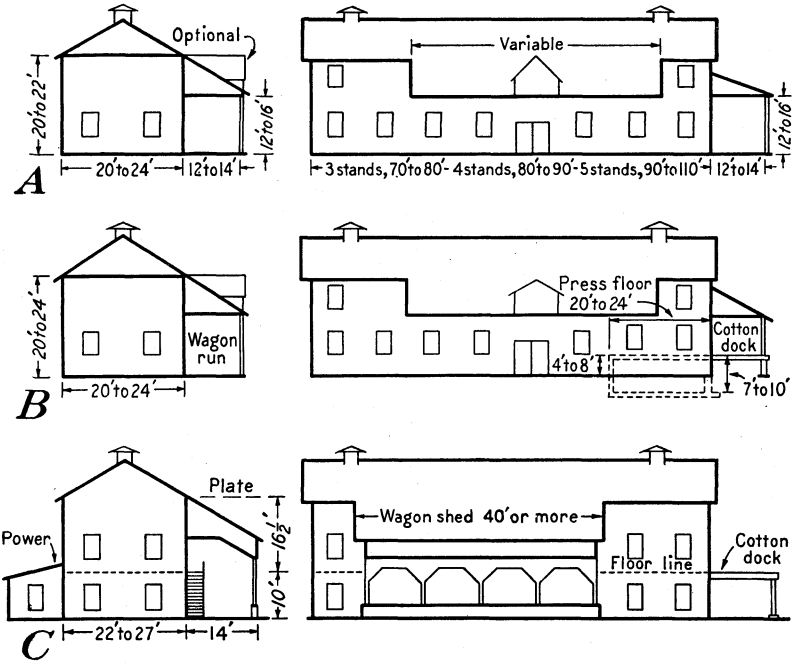

FIGURE 2.—Dimensions of modern gin buildings for single outfits: *A*, One-story gin; B, one-and-one-half story gin; *C*, two-story gin.

trusses with this in mind, the installation, removal, and rearrangement of ginning machinery is made safer and simpler.

If a gin building has more than one story or platform in connection with a ground-level floor, inclines or ramps are better than steps as bales may be moved on them easily and heavy machinery may be safely moved with rollers and block and tackle.

Buildings should be made ratproof wherever possible. Farmers' Bulletin 1638, Rat-proofing Buildings and Premises, gives information on protection against rodents. Concrete floors, parapets, and guards make this a relatively simple matter in modern all-steel construction.

Single-story gin buildings with concrete floors have been gaining in favor because they are more permanent and permit more rigid installation of equipment. For such buildings, the bale presses are either down-packing or up-packing and of the single-story type. Some form

of crane, incline, or lift is consequently needed to raise the bales from the ground level to that of the railroad platform or truck bed unless the floor level is unusually high. The use of factory-built steel doors and window sash provides protection against unwarranted entry.

In some cases a one-and-one-half-story gin building is preferred. In it machinery may be kept on the ground level and yet permit the use of a standard two-story press in conjunction with an elevated platform for cotton dock and press deck. It is desirable to have the platform of reinforced concrete and to have beneath it a half cellar with full headroom for pump, workbench, storage spaces, and miscellaneous machinery.

Very few new two-story gin buildings are now being built except on cotton farms to house relatively small outfits. These buildings are usually framed with wood and sheathed with galvanized iron. The principal advantages of a two-story gin building are that the ground floor may be used for seed sacking directly beneath the gin stands, and the main line shaft may be placed on concrete pedestals so that belt

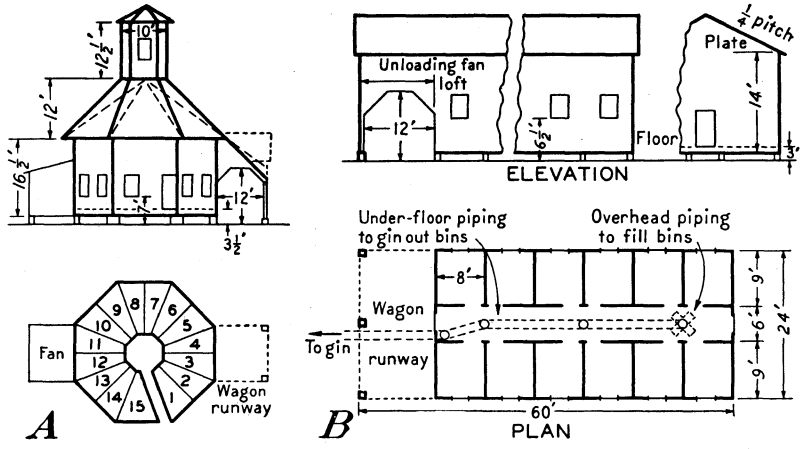

FIGURE 3.—Diagrams and principal dimensions of houses for the storage of seed cotton: *A*, Octagonal; *B*, rectangular.

drives may be carried upward through the ginning floor without occupying too much space or being hazardous to workers. However, improved ginning machinery operates best in a single-story or one- and-one-half-story building.

It is seldom that the gin building can be constructed to contain the seed cotton and seed storage; and, from the viewpoint of fire underwriters, there are many reasons why the gin building should be separate from other buildings on the premises. In many States, a minimum distance of 50 feet between buildings is required by the insurance authorities if lowest rates are to be obtained.

Figure 3 gives diagrams and dimensions for seed-cotton storage houses that are much in use throughout the Cotton Belt. The octagonal cotton house is compact and may be filled either by the suction dropper or Rembert type of cotton fan. In some instances the suction fan is within the gin building proper, and the pipe to the cotton house may be used for both suction and cotton-handling purposes.

That is to say, the piping is used for suction when the cotton house is being filled and for transferring seed cotton to the gin stands when the house is being emptied.

Rectangular cotton houses are preferred in some sections; and both belt and pneumatic systems are used for filling the bins. These houses are usually single-story, framed with wood, and sheathed with galvanized iron. The floors are preferably of wood because cement floors often collect moisture, which is detrimental to the cotton.

Storage houses for cottonseed may be of the types shown in figure 4, *A* and *B*. Those with battered or sloping side walls and ends are among the later developments. Combination, or two-story seed and seed-cotton houses are not so common as individual houses for each product but may be economically and ingeniously erected as indicated in figure 4, *C*.

COTTON DOCKS AND BALE STORAGE

The form and extent of cotton docks in a large measure depend upon the buildings and grounds. It is customary to have a sheltered dock

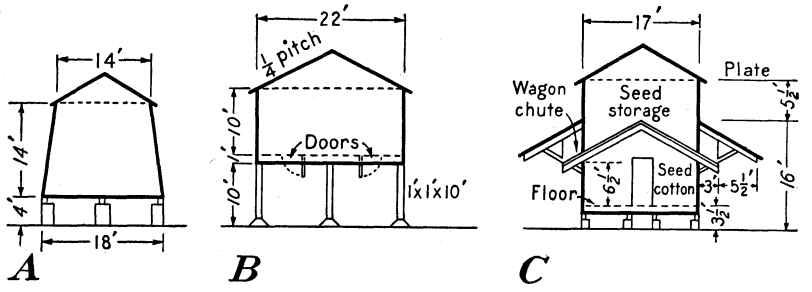

FIGURE 4.—Diagrams and principal dimensions of houses for storage of cottonseed: *A*, Ground-level seed-storage house; *B*, elevated drive under house; *C*, combined seed and seed-cotton storage.

at the end of the ginhouse with bale runway and bale platforms, either unsheltered or sheltered, shown in figure 5, *A* and *C*. The elevated skeleton platform shown at *B* is a unique method of handling cotton bales where shelter is not provided. The bale house, shown at *D*, affords complete protection in rainy weather.

Fire hazards to buildings and bales warrant fireproof construction and elimination of possibilities of conflagration being spread from burning bales or railroad equipment. It is good practice to have bale-storage facilities at sufficient distance from the gin house to prevent spreading of fire from bales to the gin proper.

CONDITIONERS

In most parts of the Cotton Belt a modernization of the ginning outfit must include the installation of conditioning or drying apparatus. Many types that employ the Government process are now on the market. The tower driers, which are described in Miscellaneous Publication 239, The Vertical Drier for Seed Cotton, may be located either on the ground level or over the distributor or overhead cleaner. Several improved methods of installation are shown in figure 6.

Among the other forms of driers on the market whose drying processes are similar to that developed by the United States Department of Agriculture are the unit extractor-feeder system of drying, multiple

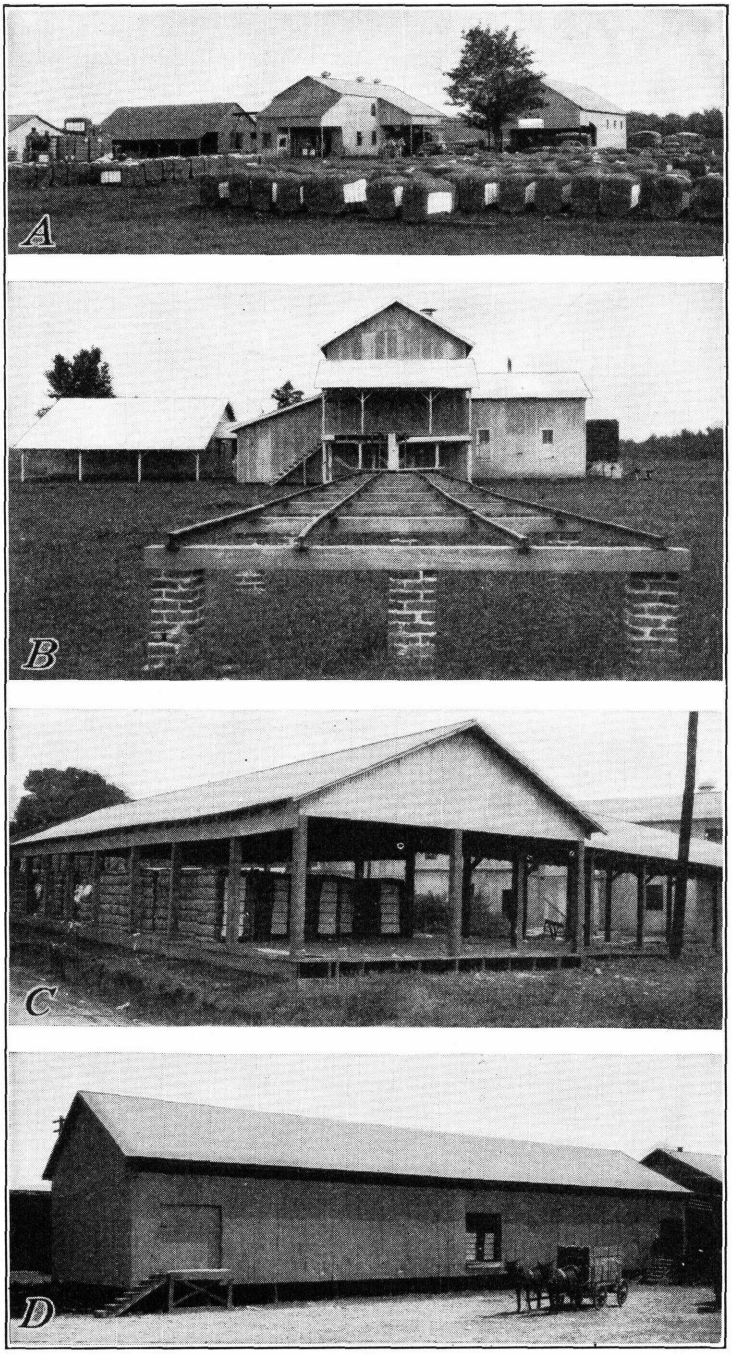

FIGURE 5.—Cotton dock and bale storage: *A*, Unsheltered on ground level; *B*, unsheltered, elevated; *C*, sheltered, open; *D*, sheltered, enclosed.

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conveyor-distributor drier, ribbon conveyor-cleaner type of drier, overhead cleaner methods of drying, multiple-cylinder axial-flow air-line cleaner-drier and revolving-floor vertical-cylinder drier, which are shown in figure 7.

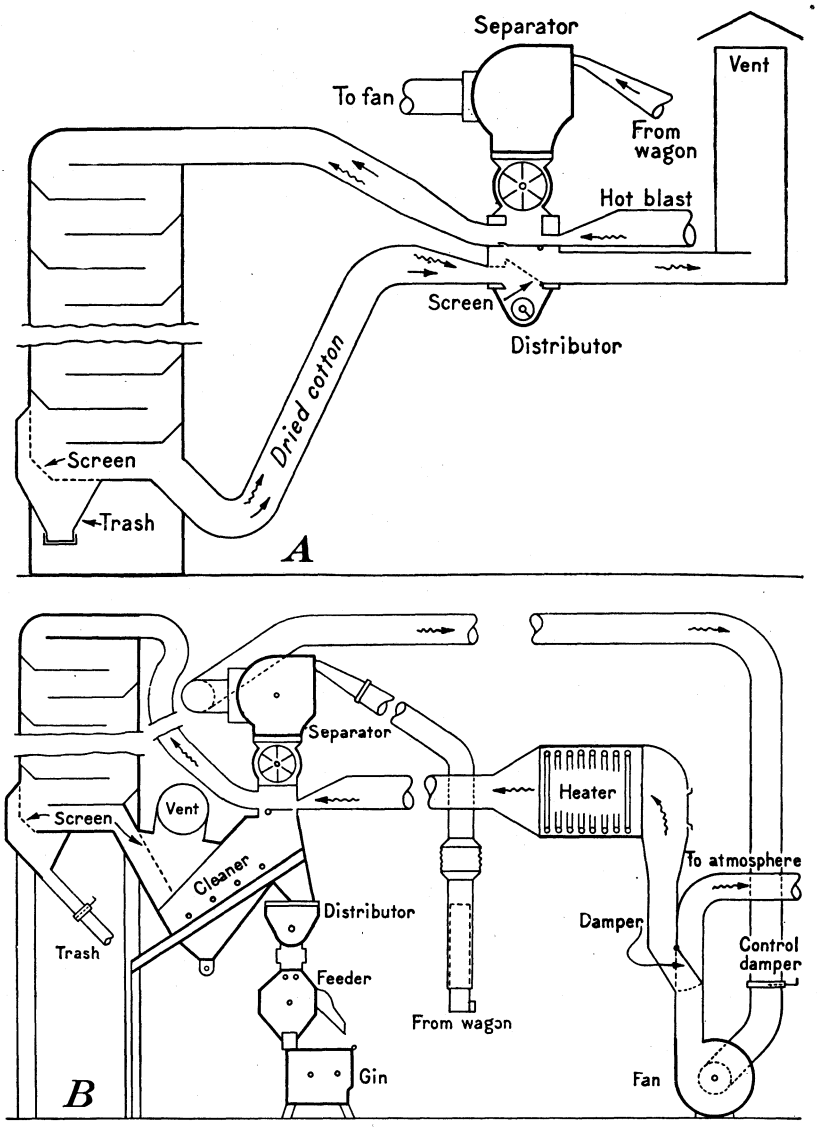

FIGURE 6.—Diagram of newer installations of the vertical seed-cotton driers: *A*, Full-length, 17-floor, ground-level pressure system; *B*, overhead, 9-floor drier combined with overhead cleaner, using single-fan method of feeding.

As many of the smaller ginning establishments cannot afford most of the driers described, the Department has developed a drying system that has a low installation cost and is inexpensive to operate. Diagrams of this system are shown in figure 8 for both mechanical and

pneumatic systems. The installation costs may be held between $500 and $700 when the gin is already equipped with an air-line cleaner.

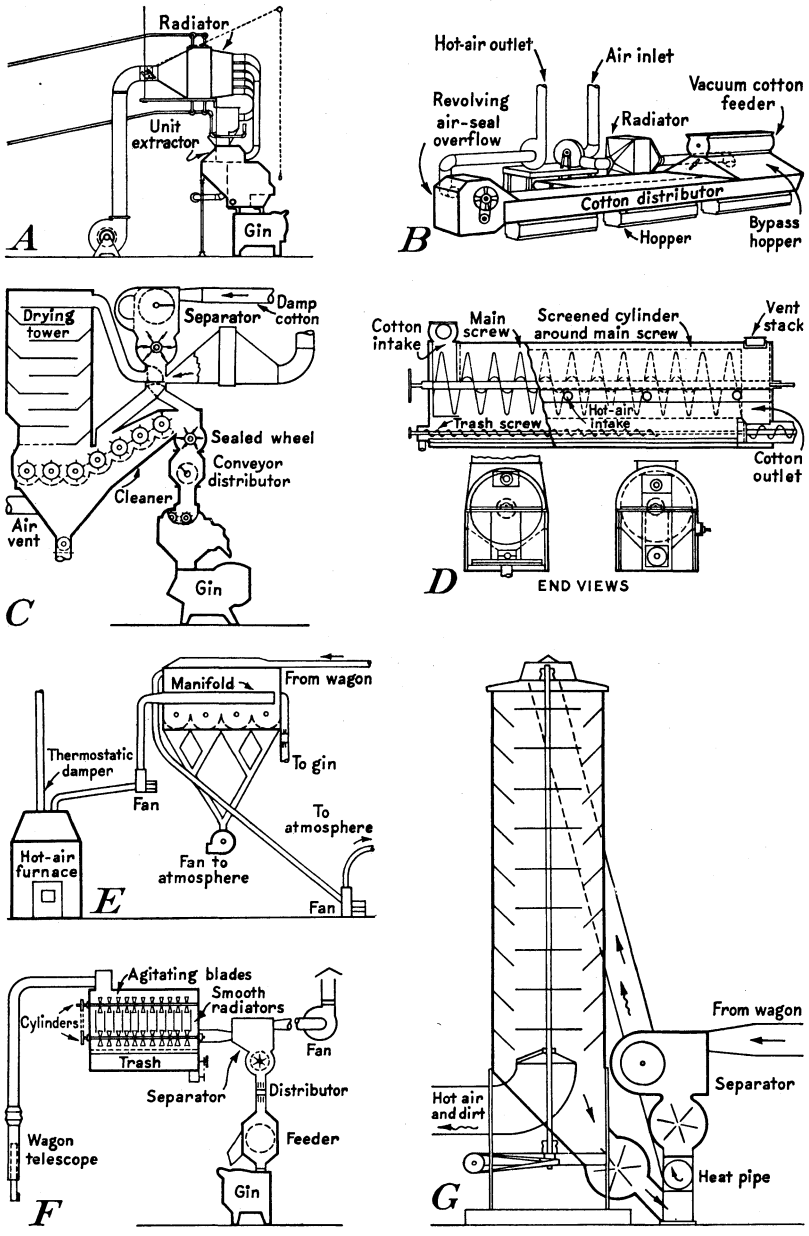

FIGURE 7.—Various forms of commercial driers on the market: *A*, unit extractor-feeder system of drying; *B*, multiple conveyor-distributor drier; *C*, overhead vertical drier and cleaner; *D*, ribbon-conveyor cleaner drier; *E*, paddle-wheel-drum cleaner drier; *F*, multiple-cylinder axial-flow air-line drier; and *G*, revolving-floor, vertical-cylinder drier.

The system involves the addition of heater coils and inlet adapter to cleaner, by means of which a hot-air suction combines with the seed-

cotton suction from the wagons so as to convert the cleaner into a drying chamber. Since one cotton fan provides the necessary suction from both wagon and heater, a fan having a capacity of 3,600 to 5,400 cubic feet of air per minute, depending on the number of stands, is necessary. This installation is especially applicable to small gins having pneumatic elevators.

The source of heat for the different driers may be either boilers or arrangements for utilizing waste heat from a Diesel or gas engine ex-

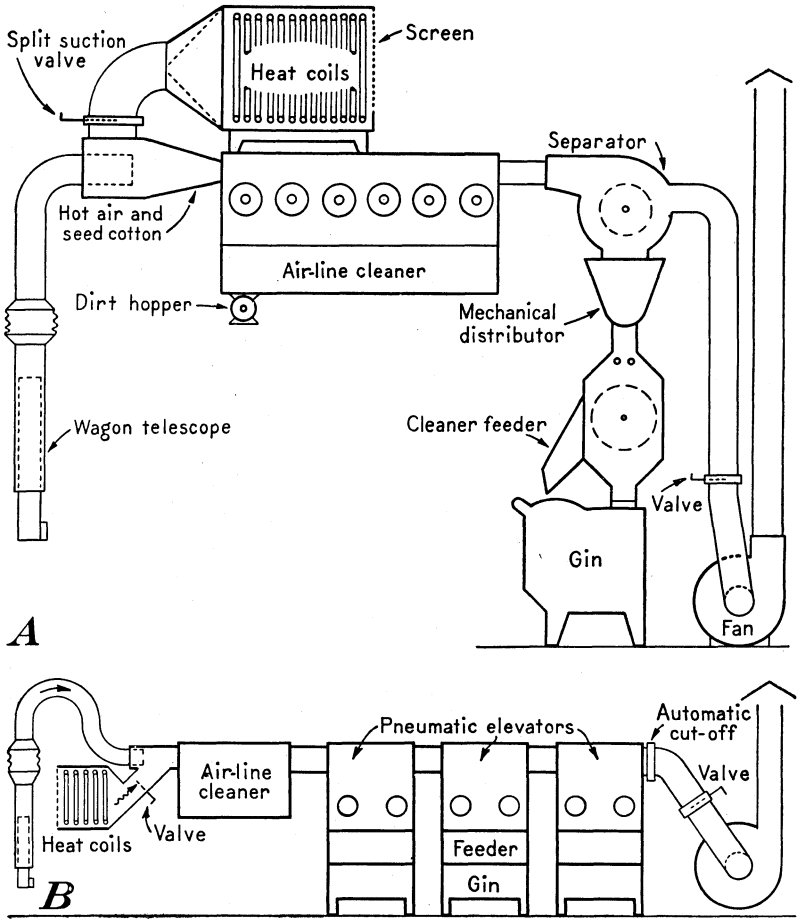

FIGURE 8.—Diagrams of air-line drier using split suction and one fan: *A*, Applied to mechanical distributing system; *B*, applied to pneumatic distributing system.

haust and radiator. It is generally desirable to install any form of drier so that its use will not interfere with the ginning service and will require a minimum of additional power. The installation shown in figure 6, *B* permits the vertical drier to be used with or without heat very beneficially and requires no additional power to operate. Some of the other forms of driers shown are, by various methods of installation, able to achieve these same effects.

CLEANERS AND EXTRACTORS

In modernizing cotton-ginning establishments, the methods of harvesting employed in the locality of the gin, the kinds of cotton, and the usual weather conditions should all be considered in conjunction with the kind of distributing system for the gins, because these factors determine the extent to which conditioners, cleaners, and extractors must be employed. More complete discussions of these subjects are to be found in Farmers' Bulletin 1748, Ginning Cotton, and Technical Bulletin 508, The Effect of Artificially Drying Seed Cotton before Ginning on Certain Quality Elements of the Lint and Seed and on the Operation of the Gin Stand.

Two forms of distributing or feeding systems are common to ginning establishments—mechanical and pneumatic. Most saw-ginning establishments in the United States utilize one or the other, and cleaning or other auxiliary equipment must be chosen accordingly.

In the mechanical system, the seed cotton may be drawn continuously from the wagon, overflow floor, or cotton house, and any surplus seed cotton is discharged at the overflow, from which it may be again returned to the handling system. This system is therefore suitable for use with many combinations of conditioning, cleaning, and extracting machinery and is now the most popular system, but it requires somewhat more power than the pneumatic system. The pneumatic system is not generally used in modern gins because it is intermittent in its suction from the wagons and cannot unload them faster than the gin stands can handle the cotton. Furthermore, it has no overflow and is not readily adaptable to the use of other than air-line cleaners, nor can it handle rough cotton effectively.

It is customary to assume that a cleaner is of the out-of-air or gravity type unless it is specifically referred to as "air line." Air-line cleaners are principally employed in pneumatic systems, but they may be used advantageously in mechanical systems to simplify the equipment or to conserve space by being placed over the wagon runway. They may be obtained in a variety of forms such as the axial-flow, cross-drum, or serpentine types. Cylinders for cross-drum types of cleaners may be equipped with spikes, spider arms, or paddles.

In general, air-line cleaners permit only a horizontal flow of the seed cotton from inlet to the outlet of the machine, but inclined cleaners are common in mechanical-distributing systems where there is little headroom. Modern forms of inclined cleaner-separator installations are shown in figure 9. The separator is mounted at the lower end of the cleaner, as illustrated at *A*, in gins where headroom is limited. Frequently the separator is placed at the upper end with a bypass so that the cotton may be discharged either to the cleaner or directly into the distributor, as shown at *B*.

Extracting units are more effective in removing burs, sticks, and other foreign matter from roughly harvested cotton than cleaners. Large extracting machines may be used in overhead positions as master extractors to serve the entire ginning battery, or small machines may be used as unit extractor-feeders to supply individual gin stands and to replace older forms of cleaning feeders.

General trends in the installation of cleaners and extractors are toward simplicity and compactness with a view to having a minimum

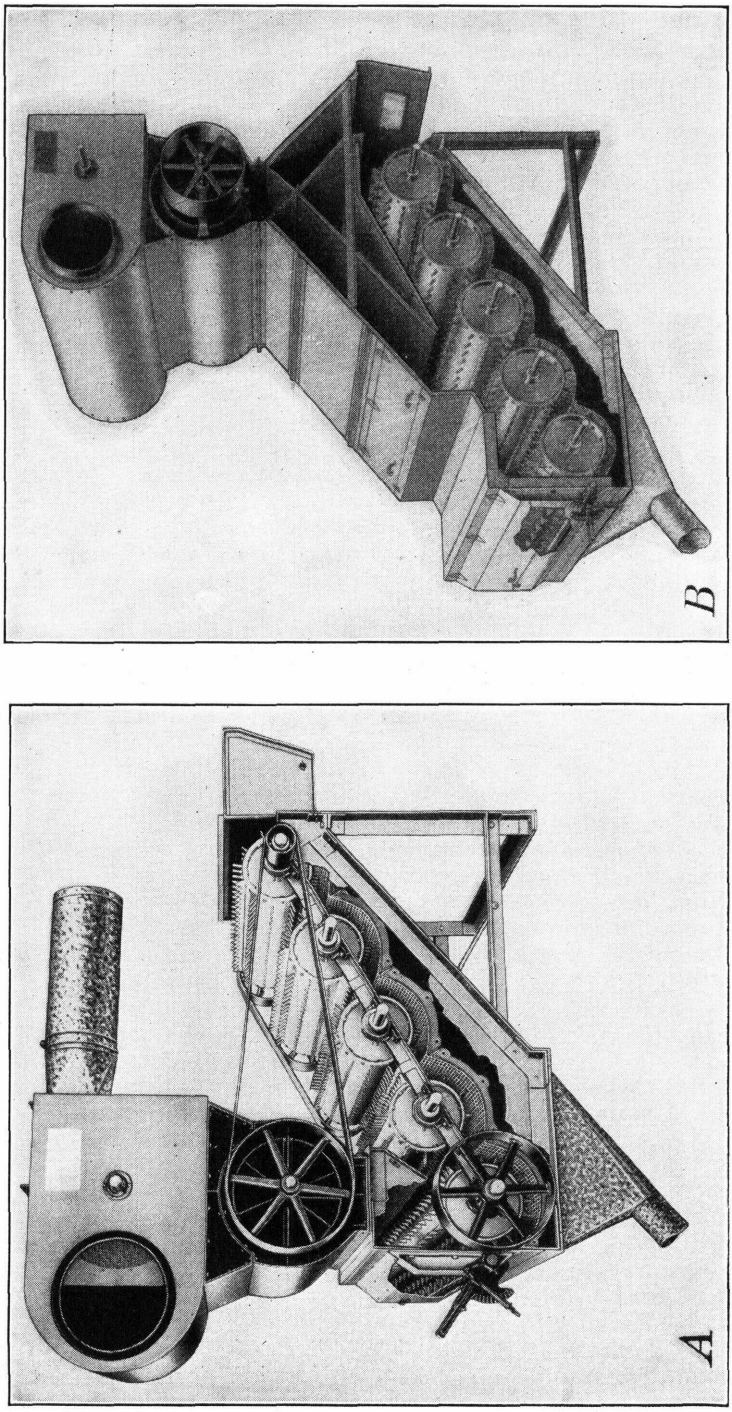

FIGURE 9.—Inclined-cleaner installations: *A*, With separator in low position; *B*, with separator and by-pass elevated.

amount of overhead cleaning apparatus. For this reason unit extractor-cleaner-feeders are frequently substituted for overhead cleaners, master extractors, and cleaning feeders.

A modern combination of overhead cleaning and extracting machinery for use in districts where cotton is usually roughly harvested is shown in figure 10.

In the Southeastern States, unit extractor-feeders placed above existing plain gin stands are a simple and economical step toward modernization. Where new gin stands are purchased, it is more desirable to obtain huller stands and combine them with unit extractors as shown in figure 11. This arrangement is very popular in the central cotton States and in many sections of the western part of the Cotton Belt.

If possible selection of cleaning equipment should be considered at the same time as the selection of the drying equipment because often,

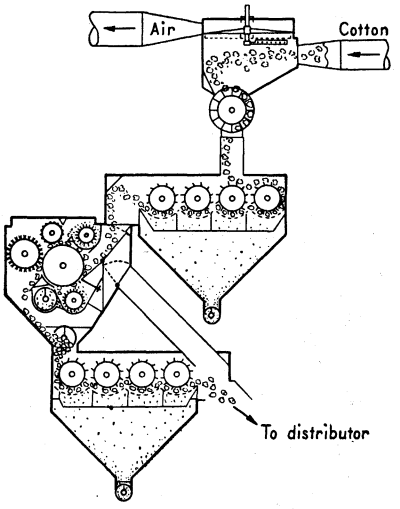

FIGURE 10.—Diagram of typical overhead cleaning and extracting combinations for districts where cotton is roughly harvested.

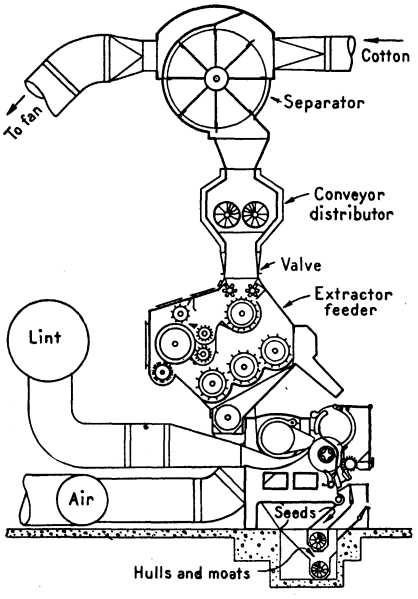

FIGURE 11.– Diagram of a huller stand equipped with a unit extractor-cleaner feeder.

with proper planning, combinations of cleaning and drying equipment can be installed together much cheaper than separately. The use of drying equipment reduces the need of cleaning equipment.

GIN STANDS

Plain gin stands are rapidly being superseded by double-ribbed huller gins whose fronts remove appreciable quantities of leaves, stems, and minor items of foreign matter even when elaborate cleaning and extracting processes have preceded them. The picker rollers on huller gins of the latest models are equipped with lever shifting devices so that the position of the roller may be adjusted to the immediate condition of roughness in the seed cotton. Beginning about 1930, gin stands

appeared in all-steel construction that are virtually rodentproof and afford a superior protection to the cylinders and brushes or nozzles. Many manufacturers now offer huller fronts as substitutes for plain fronts on certain models of gins at a cost less than $100 each, but attempts to provide huller fronts for older wooden gins are less satisfactory and may involve an expenditure up to $225 per gin stand. Sections of plain and huller types of gin stands are shown in figure 12.

HANDLING SEED FROM STANDS

Seed and trash may be handled readily by various means such as gravity, belts, screw conveyors, and pneumatic piping. There are several practical methods for handling seed so as to keep it pure. The belt and blowpipe types of seed conveying are self-cleaning, but screw conveyors must be hand-cleaned between the ginning of different varieties. The use of belt or blowpipe conveyors are therefore desirable where an appreciable quantity of seed is to be saved for planting. The following methods are among those now in use:

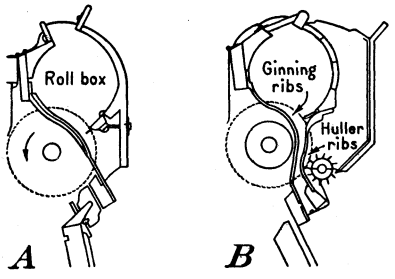

FIGURE 12.—Diagram of gins: *A*, Plain; *B*, double-ribbed huller.

1. A horizontal flat seed belt in a smooth trough below the stands, delivering either to an inclined belt or to a seed-blowing pipe through a vacuum wheel seed feeder.

2. A horizontal skeleton drag belt operating in practically the same way as the flat belt described above.

3. A reversible horizontal flat seed belt beneath the stands, operating in one direction to deliver gin-run seed, and in the other to deliver pure seed, each discharging into bins or sackers by various means.

4. Two individual conveyors beneath the stands, gin-run seed being handled in the rear system and pure seed in the front one—each system having its own lifts and deliveries.

5. Gravity chutes with hinged covers in front or below each stand, diverting pure seed by gravity into funnels and sacks below, while a standard screw conveyor is generally used on gin-run seed.

6. Gravity chutes similar to those described above but delivering pure seed into a blowpipe by means of rotating vacuum wheel seed feeders.

Improved seed conveyors are shown in figure 13.

Where vertical lifts are employed, the modern screw elevators are proving much more efficient and sturdy than the wooden-bucket elevators, whose troubles with slipping belt and faulty alignment are well-known. Seed and trash may be readily handled by belts or conveyors. In some instances these may discharge into air piping, but the operation of conveying trash and seed entirely by air is more expensive than other methods.

FANS AND AIR PIPING

The problems of piping and fans will be more readily understood by keeping in mind that the flow of air in a pipe in cotton gins is similar to the flow of water in a pipe. Quantities are measured in cubic feet per minute for the air and in gallons per minute for the water. Static

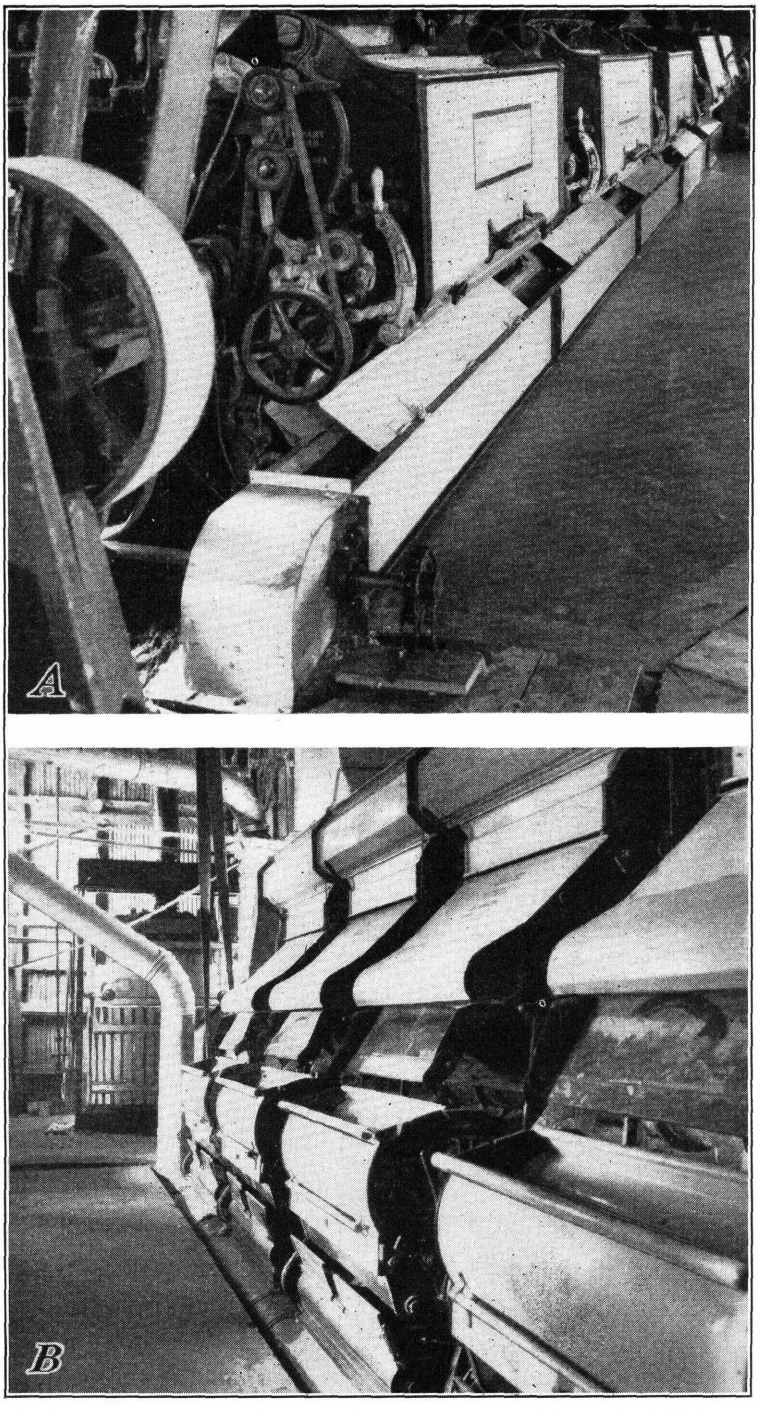

FIGURE 13.—Improved methods of keeping seed pure at cotton gins: *A*, Seed belt; and *B*, blowpipe.

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pressures in the air piping correspond to pounds-per-square-inch pressures in water pipes. Pipe sizes are selected in both to obtain the desired quantities under resistance conditions that are suitable for the fans or pumps, and friction loss in the air piping is similar to loss of head in water pipes.

Many ginners find it difficult to obtain full effectiveness from their fans and cotton piping because the fan speeds and sizes of pipe are not always correct. Waste of power and added operating expense result from both excessive fan speeds and incorrect piping.

FANS

Fans are used in cotton gins chiefly (1) to convey seed cotton from the wagon or cotton house to the ginning machinery, (2) to operate cotton conditioners or driers, (3) to supply necessary volumes of air to the doffing nozzles of air-blast gins, and (4) to convey seed, hulls, and trash.

The selection of a fan should be governed by the required air volume and system pressure as well as by the general purpose for which it is to be used. Although seed cotton or cottonseed should not be permitted to pass into the scrolls or wheels of standard fans, the use of Rembert type fans is permissible.

Two kinds of fan wheels are shown in figure 14, of which forms

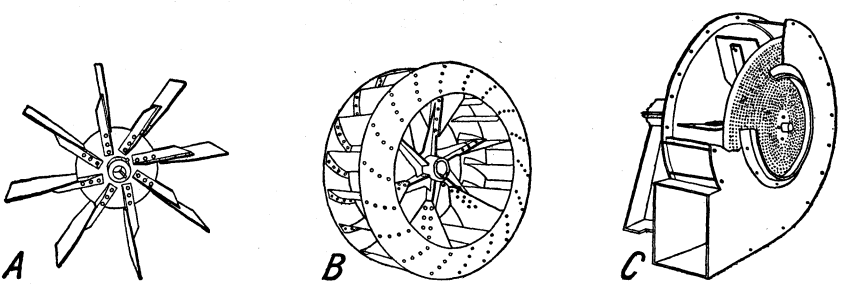

FIGURE 14.—Representative types of gin-fan wheels: *A*, Plain 8-blade wheel; *B*, shrouded 18-blade wheel; *C*, Rembert-type wheel, in the casing.

A and *B* are standard and *C* is the Rembert wheel. With equal diameters and number of revolutions per minute each of these wheels gives different volume and pressure, necessitating selection from individual-performance tables, which are usually obtainable from the manufacturers. In selecting a fan, choice should be made by specific reference to wheel diameter, kind of wheel, number of blades, and kind of casing (such as cast or steel plate), rather than employing vague terms such as "No. 35" or "35-inch" because such identifications are not used by all fan makers. In fact, the No. 15 fan of one company may correspond to the so-called 35-inch fan of another. It is a wise precaution to specify a fan wheel with a diameter at least twice as large as that of the main pipe leading to its inlet, because this choice will tend to fall within the desirable range of fan sizes that do not require excessive speed in either standard or Rembert types.

Dimensions of standard wheels in a series of any particular make are increased either in diameter or in width of wheel to produce increased capacities, as shown in table 1, which gives the range of volumes, pressures, and speeds for different diameters of standard wheels commonly used in conveying seed cotton.

TABLE 1.—*Approximate wheel diameters, advisable capacities, and safe speed ranges for standard types of cotton suction fans operating between 3 inches and 10 inches static pressure* [1]

Approximate diameter of wheel (inches)	6-blade shrouded wheel		18-blade shrouded wheel	
	Advisable capacity range [2]	Speed range	Advisable capacity range [2]	Speed range
	Cubic feet per minute	*Revolutions per minute*	*Cubic feet per minute*	*Revolutions per minute*
20	1,500–2,599	1,260–2,305	2,300–4,000	1,300–2,800
23	2,600–3,599	1,160–2,000	3,200–5,400	1,150–2,400
26	3,600–5,099	1,060–1,830	4,200–6,900	1,000–2,100
30	5,600–8,699	960–1,650	5,200–8,800	900–1,900

[1] In inches of water measured on U-tube gage.
[2] These ranges have been indicated by fan manufacturers.

NOTE.—This table is computed from performance tables of several makes of fans.

Rembert-type fans are frequently employed in cotton conditioners as well as at cotton houses for unloading seed cotton from wagons to storage bins, but it has only recently become a practice to apply such fans to ginning systems in order to replace separators and standard fans. In many cases of successful operation with Rembert-type fans, direct connections with electric motors are used. Volume and pressure characteristics of Rembert-type fans differ so much for different makes that it is desirable to consult the manufacturers for specific performance information. As a rule of thumb, however, it may be said that a Rembert fan with any given diameter wheel seldom has a capacity equal to a one-size-smaller standard fan with a wheel running at the same speed.

Housings for fans should be of the universal kind so that the fan may be used either right or left hand and be adjustable to at least eight positions. For continuous economical service, ball or roller bearings should be used on fans.

TABLE 2.—*Performance comparisons of 6-blade and 18-blade fans for air volumes at 5 inches of water, static pressure*

6-blade fan			18-blade fan		
Revolutions per minute	Volume	Brake horsepower	Revolutions per minute	Volume	Brake horsepower
1,273	2,500	3.6	1,042	2,500	3.6
1,352	3,350	5.0	1,130	3,350	4.7
1,433	4,160	6.5	1,200	4,160	5.9
1,511	4,920	8.3	1,271	4,920	7.2
1,591	5,630	10.0	1,341	5,630	8.6

When a fan that is worn out or is using too much power is to be replaced, an efficient type should be selected. Suitable fans may be intelligently selected from the performance tables that most manufacturers will supply upon request. These tables usually show a wide range in design and performance. High-efficiency fans of slow speed have greater diameters and narrower wheels than standard gin fans. The greater first cost of such a fan is offset by lower power

consumption. Table 2 shows the capacity and power requirements of 6- and 18-blade fans operating at various speeds. The figures are averages of several makes of fans.

HANDLING SEED COTTON BY AIR PIPING

From 800 to 1,000 cubic feet of air per minute is usually required at the wagon telescope to supply seed cotton to each gin stand, depending upon the type of system and the length of suction piping. If a cotton-house suction pipe is included, a modernized piping layout may be designed to give the same friction loss and constant volume from the cotton house as from the wagon telescope, affording a satisfactory conveying velocity in the largest pipe. In such a system, the wagon-telescope suction velocity may be maintained from 5,000 to 6,000 linear feet per minute so that smaller piping on this short run will give equal resistance to the longer line of larger piping to the cotton house. The selection of fan size and speed is thus simplified and more economical operation assured.

Table 3 shows typical data for balanced systems having different diameters of the various suctions but giving approximately equal resistances or static pressures for both wagon suction and suction from the cotton house. Improved types of separators having less leakage than allowed for in table 3 will reduce the speed and power requirements correspondingly.

TABLE 3.—*Sizes of cotton-suction piping proportioned to give economical fan operation and approximately equalized resistance* [1]

Gin stands (number)	Volume of air	Approximate diameter of wheel in the 18-blade fan	Suction piping						Fan speed and horsepower			
			System A [2]		System B [3]				System A [2]		System B [3]	
					To wagon		To storage					
			Diameter	Velocity	Diameter	Velocity	Diameter	Velocity	Fan [4]	Horsepower	Fan [4]	Horsepower
	Cubic feet per minute	*Inches*	*Inches*	*Feet per minute*	*Inches*	*Feet per minute*	*Inches*	*Feet per minute*	*Revolutions per minute*		*Revolutions per minute*	
3	3,000	23	10	5,500	10	5,500	12	3,800	1,500	10	1,600	11
4	4,000	26	11	6,060	11	6,060	13	4,350	1,450	14	1,500	15
5	5,000	30	12	6,370	12	6,370	14	4,700	1,400	18	1,440	20

[1] For diagram of piping, see fig. 15.
[2] With equivalent length (including elbows) of 50 feet from separator to nose of wagon telescope, and with no cotton house piping.
[3] With equivalent length (including valves and elbows) of 150 feet from separator to cotton-house suction point, and with wagon suction piping as for system A.
[4] Averaged from performance tables of several makes of 18-blade shrouded fans but not guaranteed.

Diagram plans of piping for systems A and B given in table 3 are shown in figure 15. In these systems, the wagon and overflow telescopes should be the same size, but where cotton-house suction and overflow employ the same piping in part, the size of the cotton-house line should be continued to the separator, with reduced size at the secondary valve for the overflow connection. Valves in all seed-cotton suction lines should be placed in a vertical position to prevent unequal distribution of seed cotton into the separator, and the piping from the separator to the fan should be preferably three-eighths to

one-half of the fan-wheel diameter, without reduction into the fan inlet. The piping from the separator and the fan should in all cases be equal to or greater than that for the seed-cotton suction.

In a pneumatic-elevator system (having no mechanical separator) the above rules will still apply, but if no ginned seed is to be blown by the fan discharge, a cut-off valve of the butterfly or stove-damper type will save power, since the fan is not loaded when the gins are idling.

A ginner may frequently encounter conditions in which the lengths of piping are different from those given in footnote to table 2. Under such circumstances, the use of the cotton-piping chart (fig. 16) will be of assistance in working out the friction losses in order to balance or give equal losses to the cotton-house and wagon lines.

By keeping in mind the similarity between air and water piping and by observing rule 7 (p. 21), the use of the chart will be found quite simple. For example: A certain three-stand outfit is to be installed with a 10-inch wagon telescope and suction line the equivalent length of which is 50 feet between the nose of the telescope and the valve at the separator inlet, and it is desired to lay out a system similar to figure 15, *B*, in which the cotton-house suction piping will have 80 feet of straight pipe and five 90° elbows.

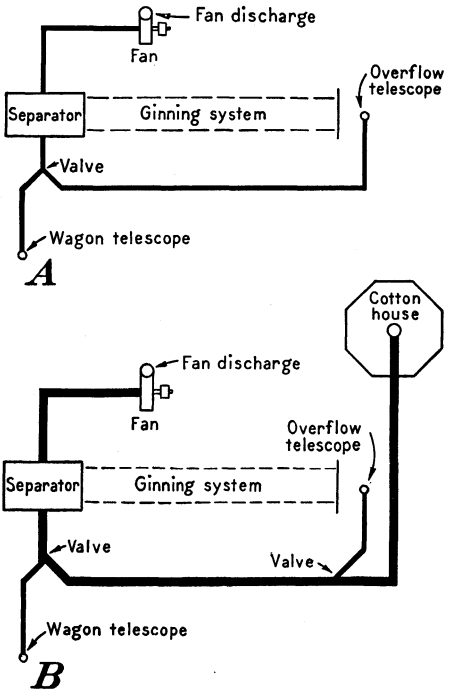

FIGURE 15.—Diagrams of typical cotton gin piping systems: *A*, With wagon suction and overflow only; *B*, with both wagon and overflow suctions and cotton-house piping.

The following is an example of the calculations required:

Wagon suction line

1. From figure 16, the friction loss per hundred feet of 10-inch piping handling 3,000 cubic feet of air per minute is 4. 80
   Since the equivalent length of the wagon suction is 50 feet its loss is 2. 40

Cotton-house suction line

2. From 1, the friction loss per hundred feet of the cotton-house line must be 2. 40
3. Equiv. length, 100 ft. units, of this cotton-house line is—
   Straight pipe 80
   Five elbows at 10 feet 50
   Total 1. 30
4. The loss per 100 feet must therefore be 2.40 divided by 1.30, or 1. 85
5. From chart (fig. 16) a 12-inch pipe will deliver 3,000 cubic feet per minute with this friction loss.

There must always be an adequate velocity in piping to provide ample suction. In the foregoing example, the dotted line for 1.85 inches of water resistance per hundred feet of piping intersects the 12-inch diameter pipe line between the 3,500 and 4,000 feet per minute diagonal lines of velocity. This is not an extremely strong suction, but it is considered sufficient to warrant the use of the 12-inch pipe. If, however, certain cases are encountered where the velocity within the pipe is indicated as less than 3,500 feet per minute, the next-smallest size of piping that will give at least a 3,500-foot velocity should be chosen.

Manufacturers' performance tables should be consulted in making the selection of the proper size of fan, but it will first be necessary to

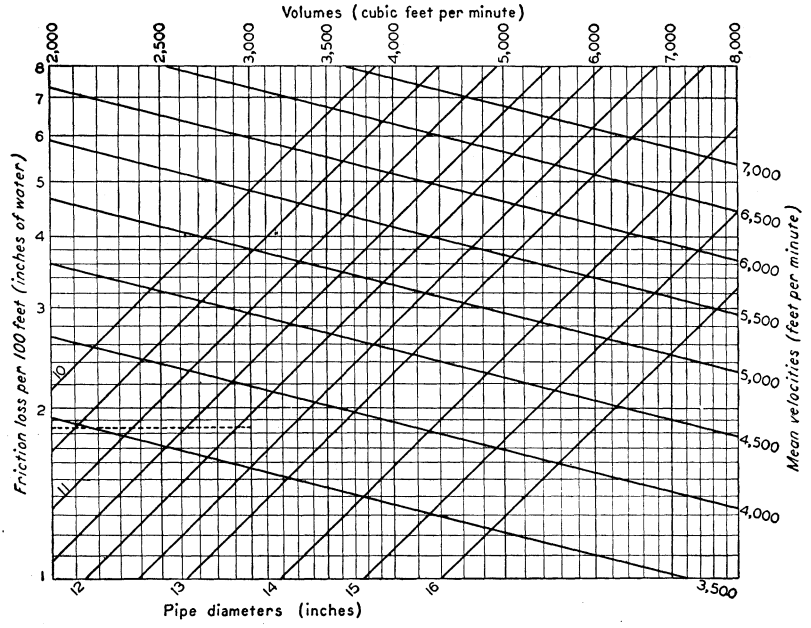

FIGURE 16.—Cotton-piping chart, giving friction losses in inches of water per hundred feet of piping for different diameters, volumes, and velocities.

estimate the static pressure, or friction loss, against which the fan is to operate and also the total volume of air to be handled before reference can be made to the correct tables. This static pressure is the sum of the suction-piping resistance to the separator, plus friction losses in the separator and piping therefrom to the fan inlet, plus any losses that may exist on the discharge piping of the fan. Separators may introduce as much as 4 inches of water-friction loss with a leakage of from 1,000 to 1,200 cubic feet per minute and the piping losses from separator to the fan inlet plus those from the fan discharge to the atmosphere may comprise another 3 inches, making the total friction loss in the example about 10 inches. In such a case the manufacturers' tables on 10 inches static pressure and 4,000 cubic feet per minute capacity should therefore be taken as the basis for fan size and performance.

In case a fan is to be installed in an existing piping system, it is advisable to obtain actual engineering observations before removing the old fan, as this will provide a simple and dependable basis for determining the required speed of the new fan.

GENERAL RULES FOR PIPING

Certain simple rules for successful installations of seed-cotton handling systems have been established after many years of experience. Some of these rules are:

1. Make the piping as simple and direct as possible by eliminating all unnecessary elbows and valves.

2. Good suction in a seed-cotton pipe requires a minimum velocity per minute of at least 3,500 feet, but velocities of 4,000 to 7,000 feet per minute are better; 4,500 feet per minute velocity is considered to be very good.

3. For blowing seed, the velocity in the pipe should be at least a mile a minute, and hence the pipe diameter should be kept between 10 and 13 inches.

4. All piping for cottonseed and seed cotton must run level or slope upward in the direction of flow. Downward slopes cause chokages.

5. Wagon-suction piping and the overflow piping should be reasonably small in order to obtain the highest velocity with the least air volume. Consequently, a 10-inch suction is best for three stands, an 11-inch suction for four stands, and a 12-inch suction for five stands. Larger suction pipes will decrease the velocity and increase the power cost.

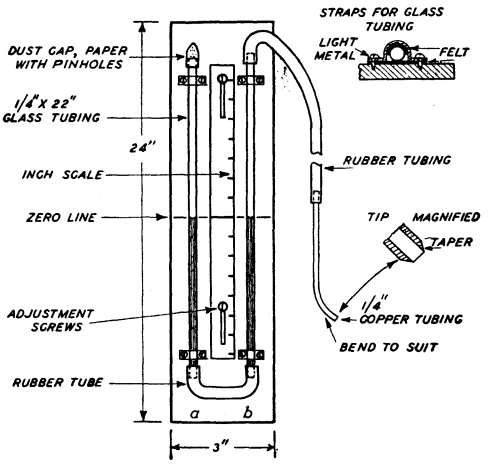

FIGURE 17.—Portable air-blast gage.

6. For cotton houses, a Rembert-type fan is simple and economical for handling the seed cotton, but a standard fan and separator with correct piping can be employed satisfactorily when used with a belt or screw conveyor in horizontal houses and with a revolving chute in octagonal houses. Fire hazards must be avoided in both systems.

7. The friction loss in cotton piping from the cotton house to the gin should approximately equal that in the wagon-suction line, so that a constant speed of the cotton fan can be selected that will be equally efficient for both.

AIR-BLAST SYSTEMS AND GAGES

The increasing use of air-blast gages is well warranted because the ginner can now keep informed regarding nozzle pressures during operation, reduce his energy requirements, and in many instances better preserve the quality of the ginned lint.

Two distinct forms of air-blast gages are available, one for portable use on individual gin stands and the other for stationary or permanent observation at some accessible place in the gin-floor operating region.

The portable gage (fig. 17) requires the material shown in table 4.

The instrument board may be either of hardwood or softwood and should be finished all over. It may be varnished to prevent warping. The glass tubing is the kind of plain tubing used in high-school chem-

TABLE 4.—*Material required for a portable air-blast gage*

Number required	Material	Description
1	Wood	Instrument board, ¾ by 3 by 24 inches.
2	Glass	Tubing, ¼ inch inside diameter by 22 inches long.
1	Copper	Tubing, ¼ inch inside diameter by 24 inches long.
1	Rubber	Tubing, for bottom of U, ¼ by 4 inches long.
1	Rubber	Tubing, ¼ by 60 inches.
1	Wood or metal	Scale, in inches.
4	Sheet tin	Straps, to fasten glass tubing.
8	Metal	Screws for clips, to suit.
2	Metal	Screws for scale, to suit.
8	Felt	Packing strips for glass and straps.
	Shellac	For cementing rubber tubing to glass or copper.
1	Paper	Dust cap with pinholes.

istry classes and is usually obtainable at drug stores or supply houses. Where possible, the sharp edges of these tubes should be rounded off by using a bunsen burner or gas flame.

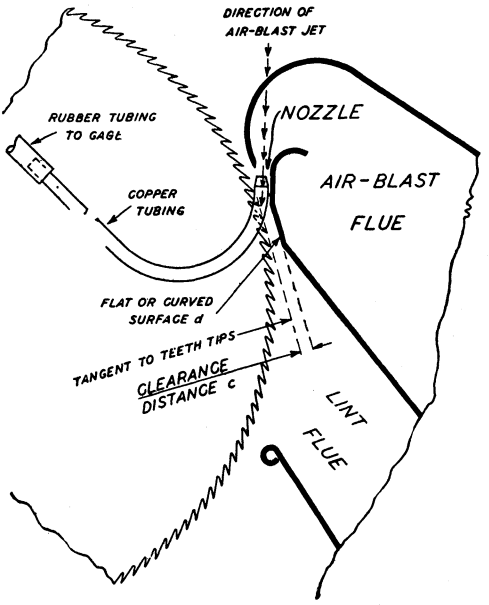

FIGURE 18.—Position of tip of copper tube for checking air-blast nozzle pressure.

The copper tubing should be of straight material, with the tip finished as shown in figure 18. The amount of binding required will depend upon the make of cotton gin.

The other items are self-explanatory.

Before putting on the dustcap, water, colored with dye or red ink, is put into the U-tube with a medicine dropper.

The level of the liquid in both tubes should be brought to the zero line of the scale. If the liquid evaporates, or if difficulties in filling the U-tube prevent bringing the liquid to the desired level, then the scale may be moved to the desired position by means of the slots and adjusting screws.

For air-tightness it is best to shellac all joints between glass and rubber, and between copper and rubber, before slipping the rubber tubing into place.

To use the gage, first see that it is plumb and that the surface of the liquid in both glasses is at the zero line. Then hold the tip of the copper tubing so that it almost touches the nozzle of the air-blast gin, as shown in figure 18. The air blast must blow into this tip in a straight line. Either end of the gin stand may be used in taking the reading, but both ends of any gin stand should give the same reading, and all gin stands in any one battery should read reasonably alike if the air-blast piping is correctly installed.

When the jet of air from the gin nozzle is blowing into the tip of the copper tube, the colored liquid in tube *a* will rise above the zero line, while that in tube *b* will fall an equal distance.

The total difference in inches between these two levels is then computed from the readings on the inch scale. For instance, if the liquid rises in *a* to a distance of 6½ inches above the zero and falls in *b* 6½ inches, the nozzle pressure is 13 inches of water, or the sum of the two readings.

If the nozzle pressures are too low for satisfactory operation, it does not necessarily mean that the air-blast fan must be speeded up. Other mechanisms in the ginning plant may be at fault, such as gin flues, air-blast piping, and nozzles. The gin flues which supply the nozzles may not be airtight, may be choked up, or may be loose at some point near the nozzles. The air-blast piping may also be leaky,

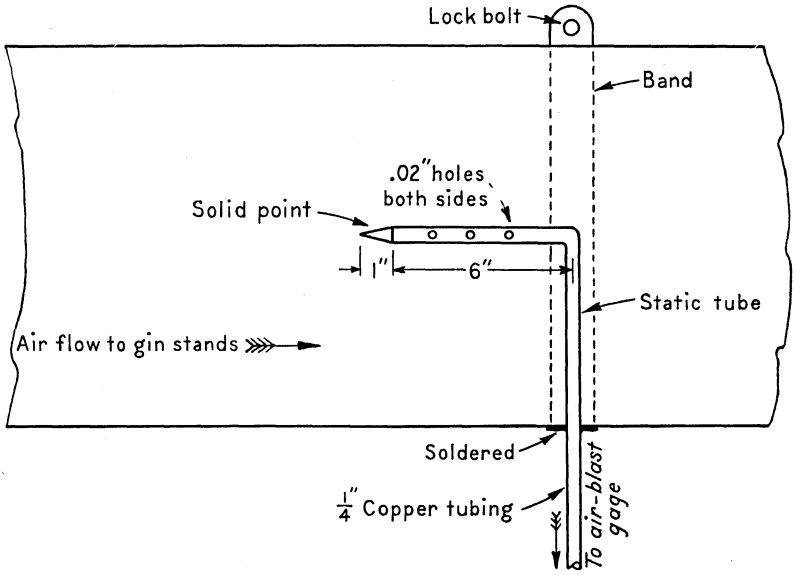

FIGURE 19.—Details of static tube and installations.

may have too many bends and restrictions, or may be choked with fly and foreign matter. The nozzles should be kept straight and free from chokage and should be adjusted so that they are parallel to the saw cylinders and the correct distance away from the tips of saw teeth. This position depends upon the make of gin and angle at which the air blast is intended to blow against the saw teeth.

In figure 18 the clearance between nozzles and tips of saw teeth is usually measured at *c*. This is taken on the curved or flat surface, *d*, below the nozzle opening. It is advisable to adjust this distance to suit the pressures, atmospheric conditions, and kinds of cotton handled.

The stationary type of gage is identical with the portable one except for the copper tubing which is to be shaped and installed in the air-blast-fan discharge pipe as shown in figure 19.

It is essential that this copper static tube be placed at the center of the air pipe and that the tip points toward the fan, that is, into the air current. The rubber tubing is usually longer than that for the portable gage, or it may be dispensed with entirely if metal piping of copper or iron is run to the gage proper. However, the rubber tubing is probably best because it will withstand vibrations without becoming leaky.

Air-blast nozzle pressures can be readily controlled by changing the area of the fan intake, and the stationary air-blast gage should be positioned so that pressures may be observed while adjusting the control device. Figure 20 is a sectional view through fan intake and screen box, showing the air-blast pressure control devised at the ginning laboratory. This arrangement gives the ginner fingertip control

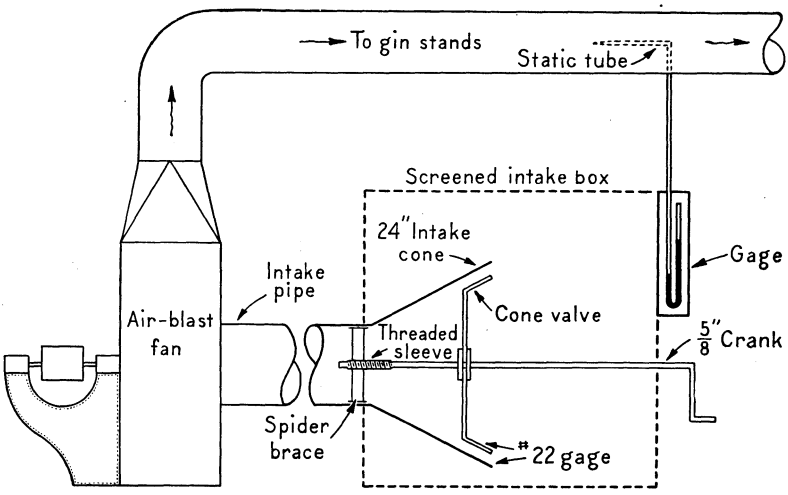

FIGURE 20.—Features of the Government-designed air-blast fan-intake control and gage.

at all times without the necessity of changing fan speed. On sunny days with dry cotton the air-blast pressure may be reduced as low as 10 inches on the water gage; damp weather and wet cottons may necessitate a higher pressure to get the best ginning.

Where a slide damper is used instead of the cone on the intake pipe, it should be placed as far away from the fan as possible, to minimize cavitation and air eddies that tend to prevent uniform entrance of the air into the fan housing. It should also be borne in mind that slide dampers do not regulate air volume in exact proportion to the size of the opening. In other words a half-open damper does not reduce the air volume to 50 percent of that obtained by a full opening. Adjustment of the damper by observation of the air-blast gage will, however, enable the ginner to obtain the desired pressure for best operation.

If it becomes necessary to speed up an air-blast fan, it is important to remember that capacity varies directly with the speed, that pressure varies with the square of the speed, and that power varies with the cube of the speed. For example, in supplying a 3–70 outfit suppose we have a fan delivering 3,868 cubic feet of air per minute at 1,404 revolutions

per minute with 11.7 horsepower and a pressure of 11 inches on the gage. By speeding up the fan to 1,520 revolutions per minute, we increase the horsepower to 14.8 and the pressure to approximately 13 inches and the delivery of air to 4,187 cubic feet per minute.

These fan-relation ratios may be stated as follows:

$$\frac{\text{Original volume}}{\text{Final volume}} = \frac{\text{Original speed}}{\text{Final speed}}$$

$$\frac{\text{Original pressure}}{\text{Final pressure}} = \frac{\text{Original speed squared}}{\text{Final speed squared}}$$

$$\frac{\text{Original horsepower}}{\text{Final horsepower}} = \frac{\text{Original speed cubed}}{\text{Final speed cubed}}$$

The air-blast fan is, at best, a rather inefficient pump. Its intake should therefore be arranged so that air will flow smoothly into the casing and so that its discharge piping is as simple as possible. Control of volume and pressure is much more economical on the inlet than on the outlet of these fans, and for this reason it is not good practice to insert any dampers in the fan discharge.

GIN-MACHINERY AUXILIARIES

The profitable operation of a cotton gin frequently depends in part upon such auxiliaries as the power, bearings, belts, pulleys, and other pieces of equipment; hence they should be selected with care.

POWER AND MOTIVE UNITS

The principal characteristics desired in cotton-gin motive units and power service are constant speed, ample capacity to handle overloads, durability or long life, and cheapness in operation and maintenance. Each of the various forms of motive unit now available has significant advantages and disadvantages. The most common sources of power are, of course, electric motors, and steam, Diesel, gas, and gasoline engines.

In determining the most desirable type of motive power for a given installation, consideration must be given to the first cost of the equipment, the cost of fuel or electric energy to operate it, the cost of lubrication, kind of labor needed, expense of maintenance, probable length of life, and decrease in power capacity resulting from use.

The amount of electrical energy required will vary considerably, depending upon how constant and intermittent loads are handled, and upon the extent of the use of fans and other accessories. In electrically operated gins, it is highly advisable to separate the various loads so that intermittent work of pumps, presses, and seed loading into cars or trucks will be done with separate motors rather than from the main motor. Electric-power companies usually give consulting and testing services to their patrons, and gin owners may use such services to obtain economical operation.

Steam gins appear to be decreasing in number because they are not conveniently adaptable to intermittent and prompt service and because supplies of cheap fuel are disappearing. Furthermore, some State regulations are increasingly stringent in that steam boilers are

now subjected to periodic inspection and licensed operation. However, modern steam engineering has made such rapid improvement in construction and practices that large commercial gins might obtain very effective and economical installations. Where steam is available for ginning cotton it has the added advantages of being on hand for conditioning equipment and for extinguishing fires.

Diesel, gas, and gasoline engines have much to commend them for the seasonal service of cotton ginning. In selecting such engines the purchaser should allow for a liberal margin in power over that which is actually required. Most manufacturers now list their engine ratings at the maximum power produced when the engines are new,

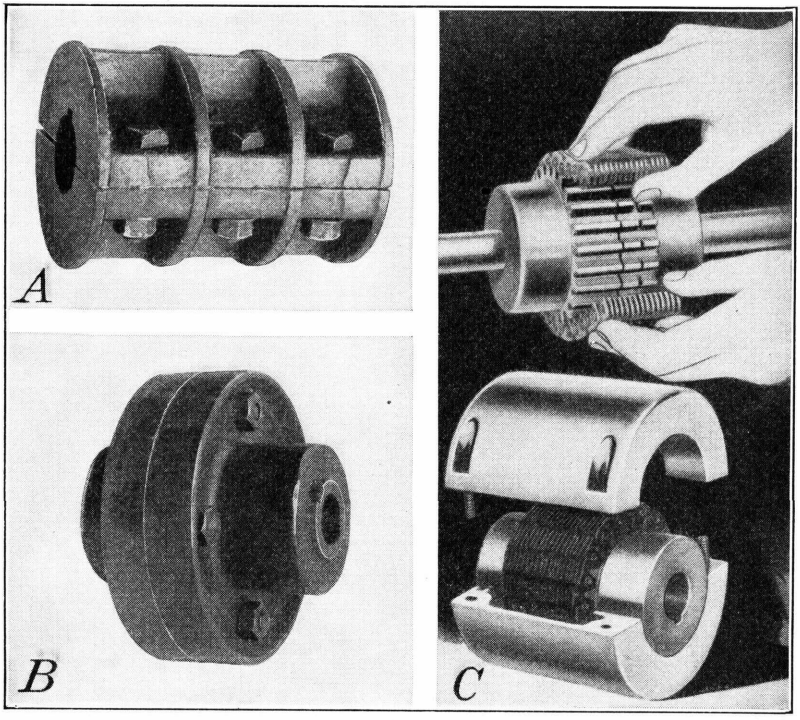

FIGURE 21.—Safety shaft couplings: *A*, Marine type; *B*, flange type; *C*, flexible-chain type.

and the purchaser should bear in mind that the capacity will decrease with service.

POWER TRANSMISSION

All shafting and bearings consume power, and ball or roller bearings should be substituted wherever possible for plain bearings. All such frictionless bearings must be carefully guarded against damage from grit and dust, and approved commercial types designed for such service should be selected. The alinement of shafting and bearings is important to the uninterrupted and economical operation of any gin and necessitates suitable pedestals or other anchorages for the bearings. For two-story gins, concrete pedestals are desirable on the ground floor but for single- or one and one-half-story gins, adjustable iron floor hangers are frequently preferable. Where the shafting is

built up of individual lengths coupled together, it is much better that the drive should be made at the center rather than at one end so that torsion and breakage may be minimized. Couplings should be of the safety types shown in figure 21.

In making new installations of shafting with the accompanying belting and pulleys an endeavor should be made to eliminate as many belts and pulleys as possible, because they constitute a possible source of trouble and power loss. Flat belts of adequate center lengths are approximately as efficient as V-belts; but V-belts, when properly selected, can be employed to make very neat, short, safe drives; and under certain circumstances, can be utilized even for right-angle drives.

In selecting either flat or V-belts, the actual load must be kept below the maximum capacity of the belt selected. It is far better to have oversized flat belts or a few extra V-belts in any drive than to face the delay, expense, and possible damage that may arise through the use of undersized belts. Seasonal service at cotton gins enables operators to use composition beltings of various kinds, but the greatest economy does not necessarily lie in the cheapest belt; and the duty of each drive should be carefully considered in specifying the kind, capacity, and other details of the belt involved.

SEPARATORS AND DISTRIBUTORS

The air handling systems in cotton gins are usually operated in conjunction with separators, pneumatic chutes, distributors, lint flues and condensers. The general requirements for the seed-cotton suction and air-blast piping have already been discussed. The allowance of 800 to 1,000 cubic feet of air per minute per gin stand previously made for the unloading system does not include an estimated 1,200 cubic feet per minute for air leakage and losses at the piping joints and separators, which frequently have faulty vacuum wheels or poorly fitted distributor seals. Improved forms of separators now on the market employ revolving screens and vacuum wheels which handle much damper and trashier cottons with lower air losses and fewer chokages than will the older stationary-screen types. Various types of modern separators are shown in figure 22. The use of revolving vacuum wheels in connection with the separators has proved to be superior to using a belt distributor with solid flaps in order to obtain an air seal. A vacuum wheel is also desirable when other than belt forms of distributors are used, or when one separator is used for two purposes as in several kinds of modern drying installations.

Distributors of various forms have comprised the backbone of ginning outfits since the introduction in 1883 of air piping for handling seed cotton. The marked improvement in separators that began about 1928 was accompanied by the immediate development of better distributors—the principal forms being those in all-steel design of screw and gyrator type to replace belt and pneumatic-elevator distributors. Screw distributors or conveyors are on the market with both single and double flights, ranging usually from 10 to 16 inches in diameter and making from 100 to 150 revolutions per minute in a sheet-steel trough, in the bottom of which are pivoted change-bale valves to control the feeding of units beneath. Gyrator distributors incorporate a tedding or kicking action through spring-steel wires for moving the seed cotton along a sheet-steel trough to the change-bale valves and overflow.

Modern distributors require little attention beyond periodic lubrication, are rigid and self-alining to a great degree, use less power than belt distributors, and reduce fire hazards.

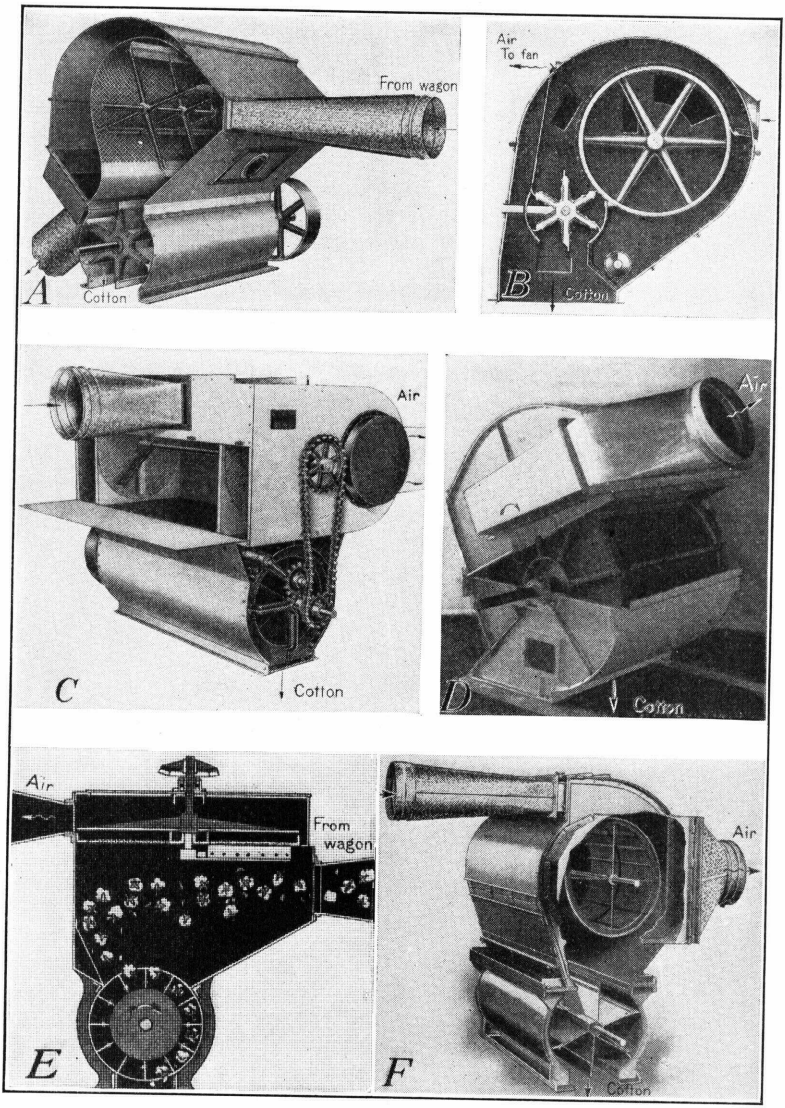

FIGURE 22.—Diagrams of modern types of separators: *A*, Stationary curved-screen type with wiping reel; *B*, revolving cylindrical-screen type with trash conveyor; *C*, Vertical double-perforated-disk type with rotating wiper and suction equalizer back box; *D*, revolving partitioned-cylinder type with end screens on cylinder; *E*, stationary horizontal-screen type with underside suction and rotary wiping cut-off; *F*, revolving drum-screen separator.

LINT FLUES AND CONDENSERS

Lint flues may be located either above or below the level of the operating floor in a cotton gin, as shown in figure 23. Although the majority of lint flues are above the floor, in some recent installations lint flues have been placed below the floor to conserve space.

Dust backs or cleaning screens connected with condensers, when properly installed, have proved a satisfactory aid in removing pin and pepper trash from the ginned lint. They should be cleaned daily, however, and kept in first-class condition.

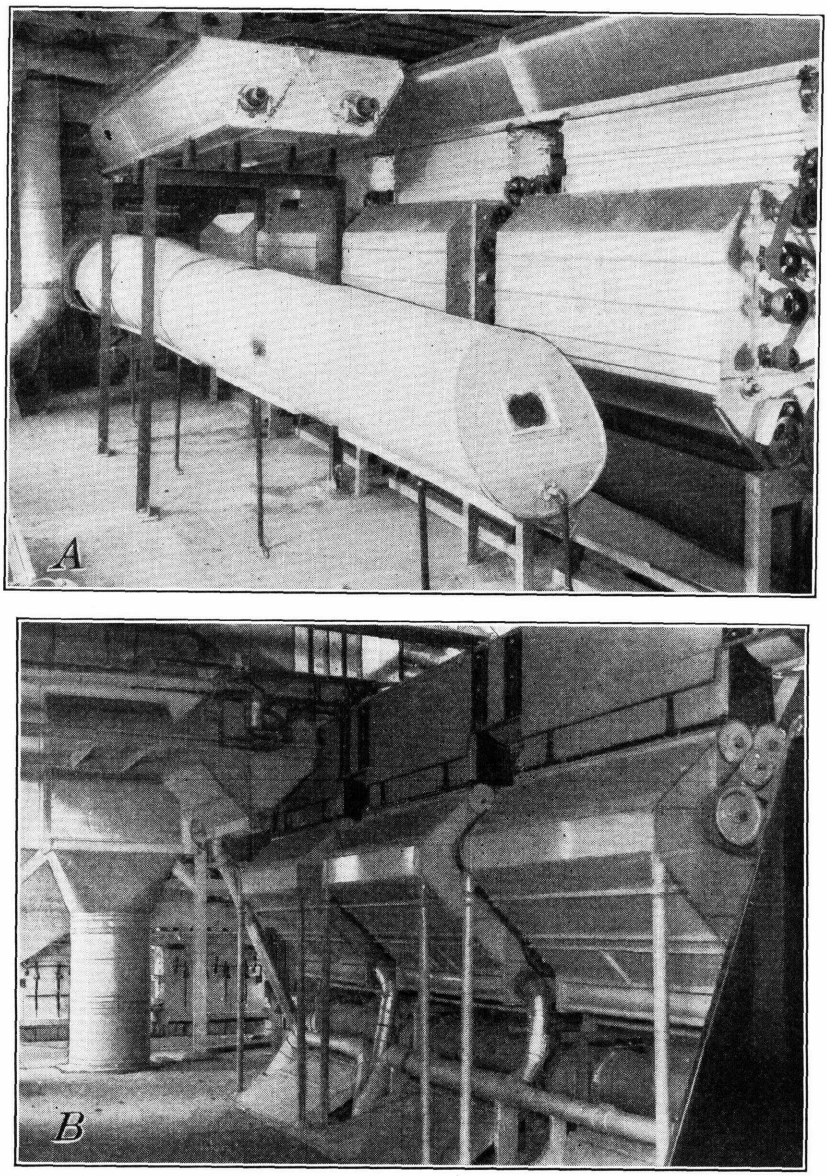

FIGURE 23.—Installations of lint flues: *A*, Above operating floor; *B*, below operating floor.

The maintenance of proper static pressures in lint flues is very important because too much pressure will produce backlash, with its attendant trouble, especially if the condenser is not large enough.

Lint-flue pressures should not exceed one-half inch for brush gins or three-fourth inch for air-blast gins. Where ginners install only a part of the gin stands necessary to begin operation of a new gin, it is desirable to obtain the proper size of lint flue for the full number and install the stands nearest the press first so that extensions of the lint flue can be made if additional stands are installed.

All-steel condensers may now be obtained for either up or down discharge, and when of adequate size and properly installed, should give little trouble from prevailing winds if properly shielded by dust caps or a dust shed. Diagrams of typical up-draft and down-draft condensers are shown in figure 24.

PRESSES, TRAMPERS, AND PUMPS

The trend in modern cotton-gin presses has been toward all-steel construction, hydraulic pressing, and mechanical tramping. Double-box types have supplanted most of the single-box presses in all except a few of the older small gins and are on the market in up-packing and down-packing designs.

Hydraulic power for pressing has to a large extent replaced screw power because it is simpler, more powerful, and more dependable. With it, presses are readily adaptable for either up packing, such as is usually found in one and a half-story and two-story gins, or for down packing, as found in one-story gins where the bales are tied out almost at ground level.

Hand-controlled trampers are obsolete, and very few steam or hydraulic ones are being purchased although their mechanical features have through years of experience become very dependable.

Modern double-box presses have departed from the drop-down swinging doors that require counterweights, using instead improved side swinging doors with hand-wheel locks and other safety attachments.

The form of hydraulic pump used in modern gins depends largely upon the kind of power used, and may be a motor-driven individual unit or may be belted to the main-line shaft. As a rule, triplex pumps are desirable because of their smooth operation and freedom from trouble. They may be either vertical or horizontal and may be provided with either tight and loose pulleys or V-belts so that they may run steadily or be idle between the pressings of bales.

It is generally advisable in motor-driven gins to operate the press pump with a separate motor so that variable peak loads are not imposed upon the main motor and so that power consumption may be reduced during periods when the pump is not needed. Figure 25 illustrates such a pump.

SCALES FOR WAGONS, BALES, AND SEED

Methods of weighing seed cotton, seed, and ginned lint differ widely in different sections of the country. Some gins employ only one set of wagon scales for weighing everything, while others utilize wagon scales to weigh the incoming seed cotton and outgoing wagon-loads of seed, the bales being weighed on yardarm scales placed near the press. The most modern installations employ (1) a wagon or truck scale for weighing incoming loads of seed cotton and outgoing loads of seed; (2) platform or yardarm bale scales located adjacent to the press; and (3) special seed scales located between the gin stands

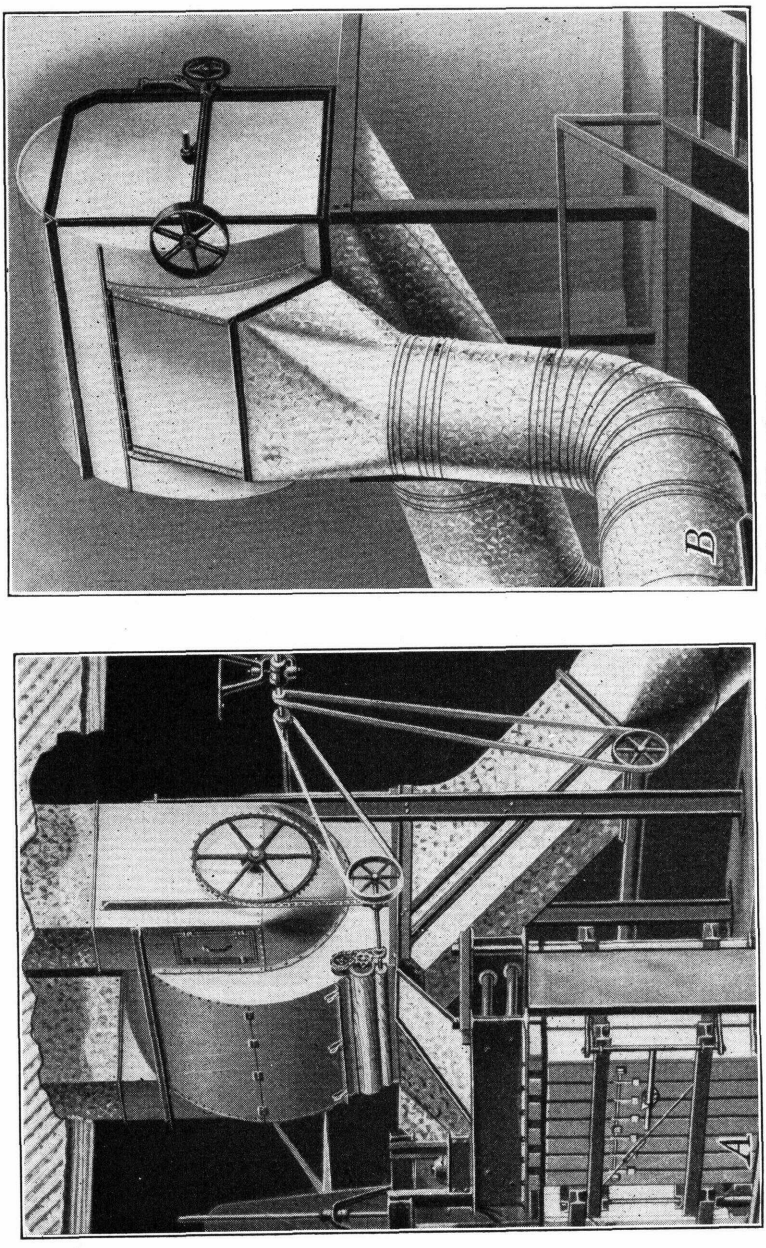

FIGURE 24.—*A*, Up-draft condenser; *B*, down-draft condenser.

and the press so that the weight of seed per bale can be obtained during the ginning process. Figure 26 is from a photograph taken in a single-story gin, showing the method of installation of a modern seed scale. After the seed has been weighed in the seed scales, it is conveyed by vertical lifts to the transfer conveyor that carries it either to the storage, to the railroad car, or to the wagon bin. Three forms of lifts are customarily employed; namely, bucket elevator, air and screw.

APPEARANCE OF GINNING ESTABLISHMENTS

The buildings and grounds of a modern ginning establishment present a clean, businesslike appearance in contrast to the unkempt, bankrupt atmosphere of obsolete gins. Trash and refuse are not allowed to accumulate; surplus machinery is neatly stored under shelter; condenser vents are kept free from fibrous streamers of dirty lint; and paint is applied for appearance as well as preservation.

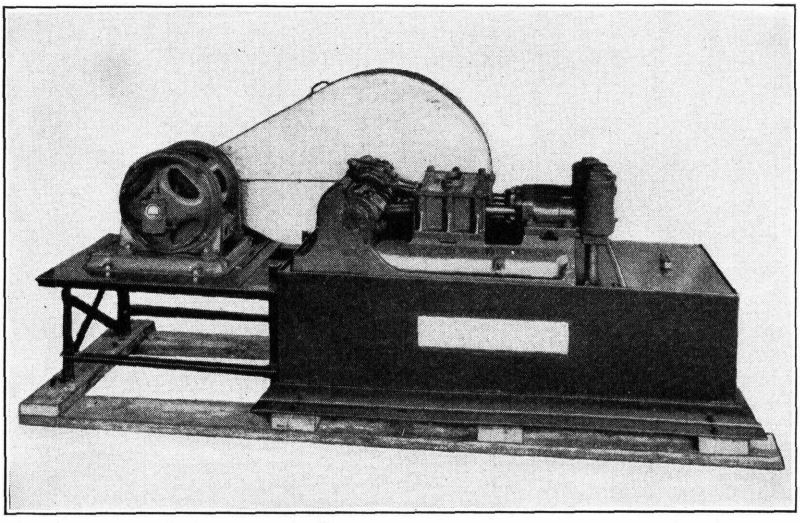

FIGURE 25.—Motor-driven hydraulic pump.

Muddy lots are seldom found at modern gins, and customers may drive their loads on graveled roadways beneath welcome shelter sheds to await their turns. Good drinking water and clean toilet facilities add greatly to the comfort of the customers.

For metal buildings in the South, aluminum paints with oil or asphaltum bases are probably the most durable, if the surfaces have weathered for a few months before the paint is applied.

For wooden surfaces, metallic oxide paints in reds, browns, and greens appear to be very durable, and these colors are generally available in composition shingles for such structures as shelter sheds and storage buildings.

Planting trees and shrubs about the gin lot adds greatly to the attractiveness of the place.

EXAMPLES OF MODERNIZATION

The essential features of a modern cotton gin and the improvements that can be made in existing gins have been discussed. Some of the

more popular features and improvements are illustrated in succeeding figures. One of the most important trends in modernization is the installation of conditioning equipment for drying green, damp, or wet seed cotton. Interior views of gins before and after the installation

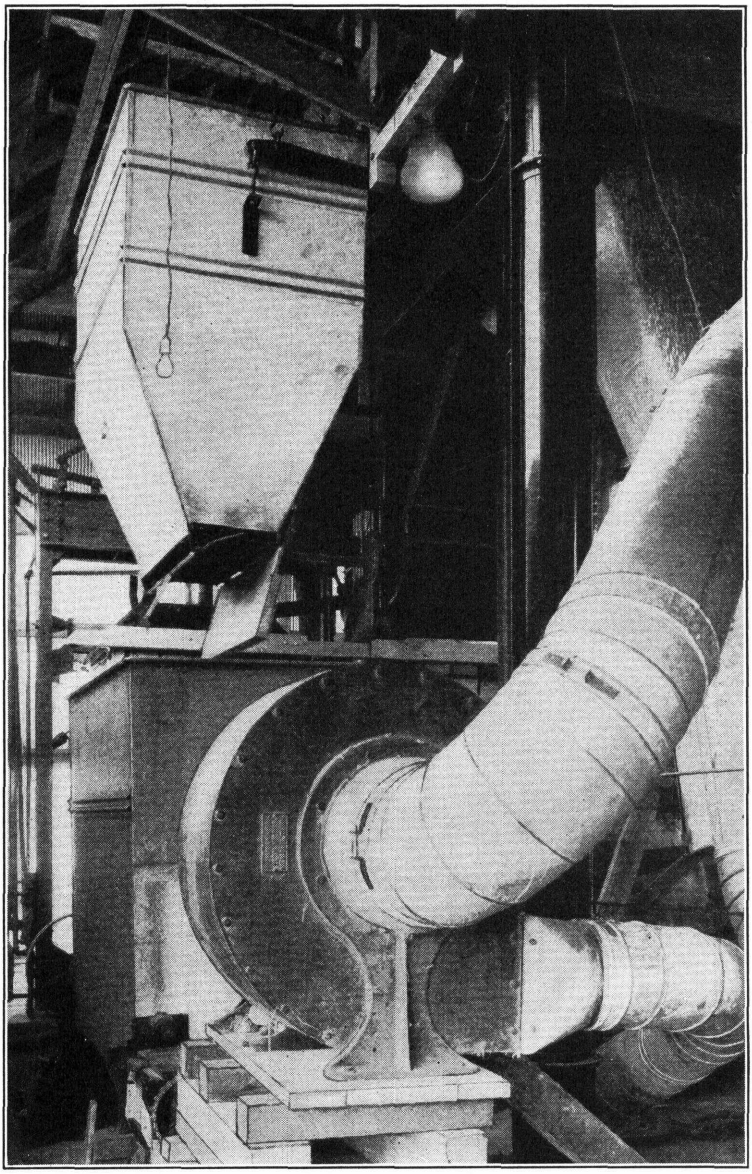

FIGURE 26.—Seed scales employed in a modern cotton gin.

of vertical cotton driers, a unit extractor system of drying, and a conveyor-distributor drier are shown in figures 27, 28, and 29, respectively. The arrangement of the vertical drier between the separator and belt distributor has the advantages of simplicity of installation

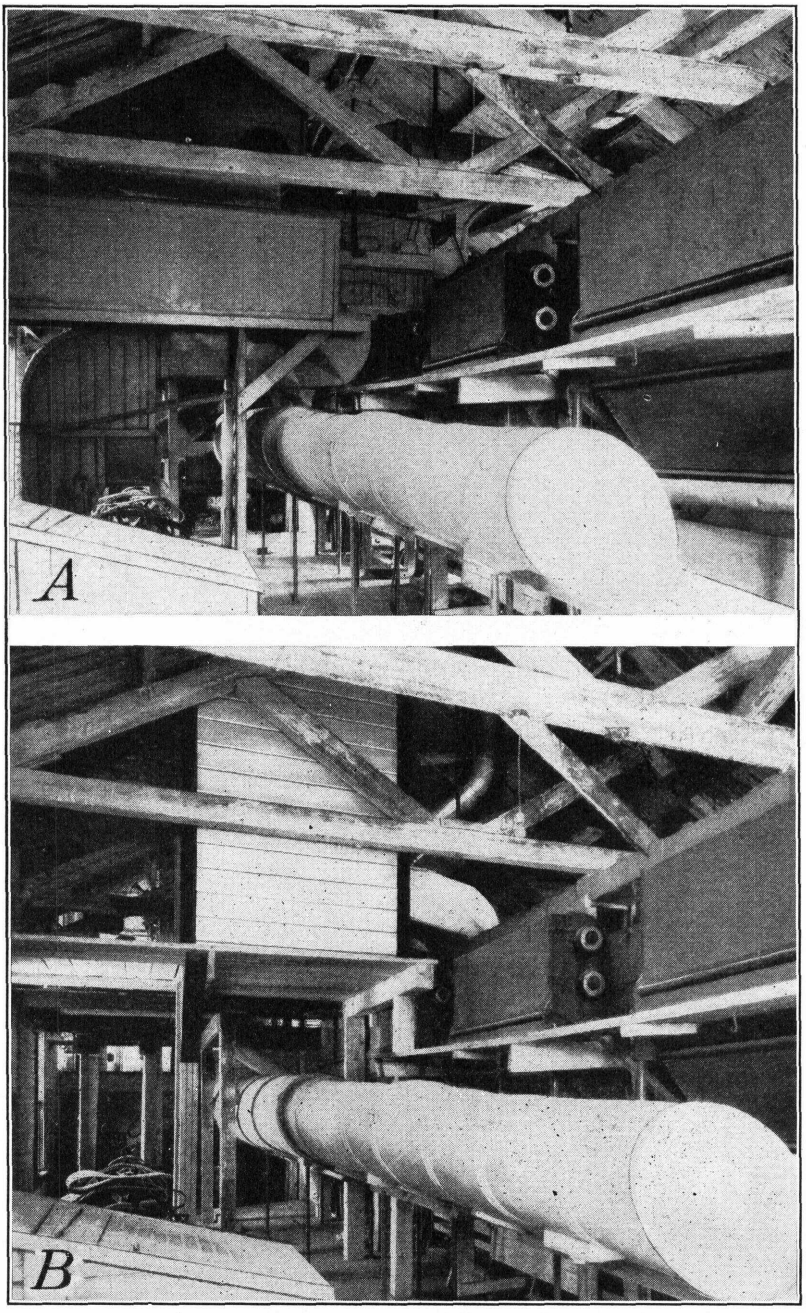

FIGURE 27.—Gin outfit (*A*) before and (*B*) after the installation of Government-designed vertical drier.

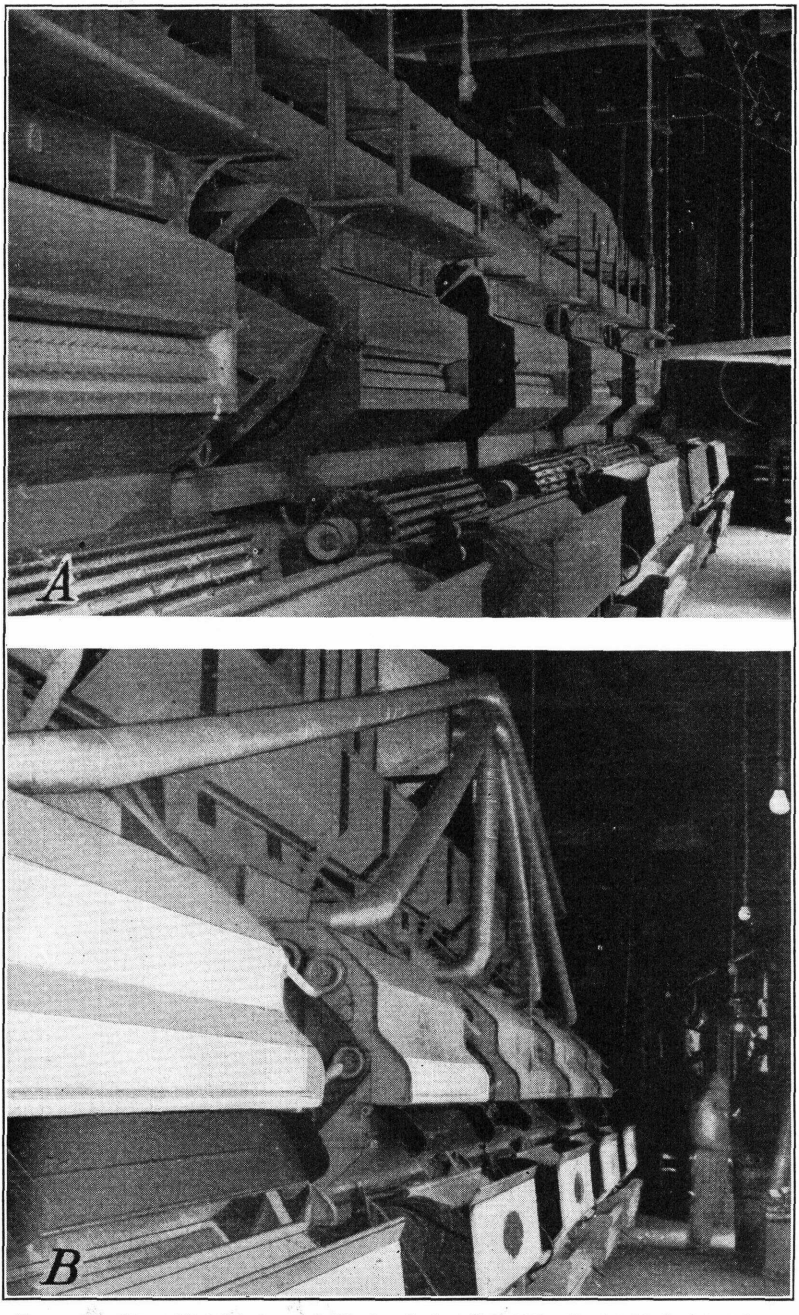

FIGURE 28.—Gin outfit (*A*) before and (*B*) after the installation of unit extractor drying system.

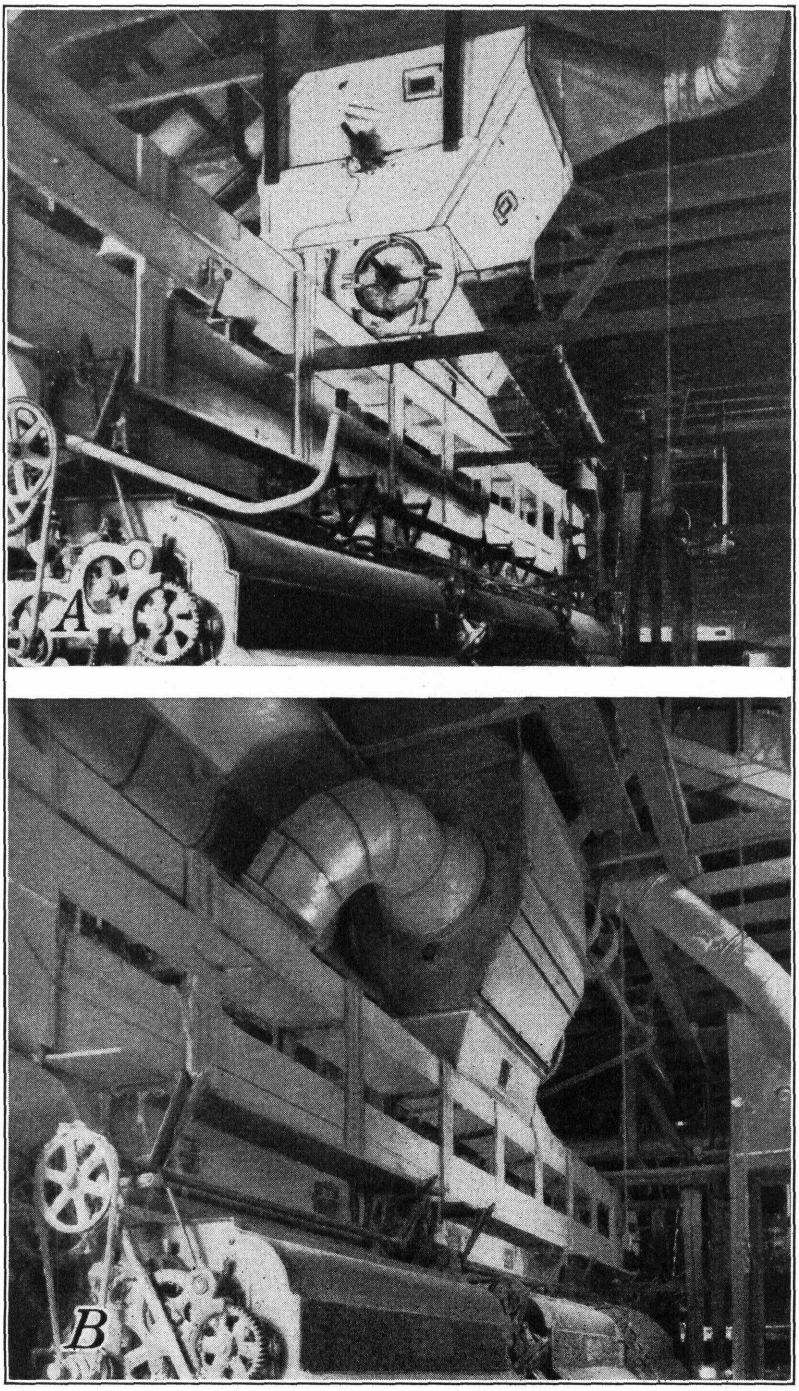

FIGURE 29.—Gin outfit (*A*) before and (*B*) after the installation of a conveyor-distributor drier.

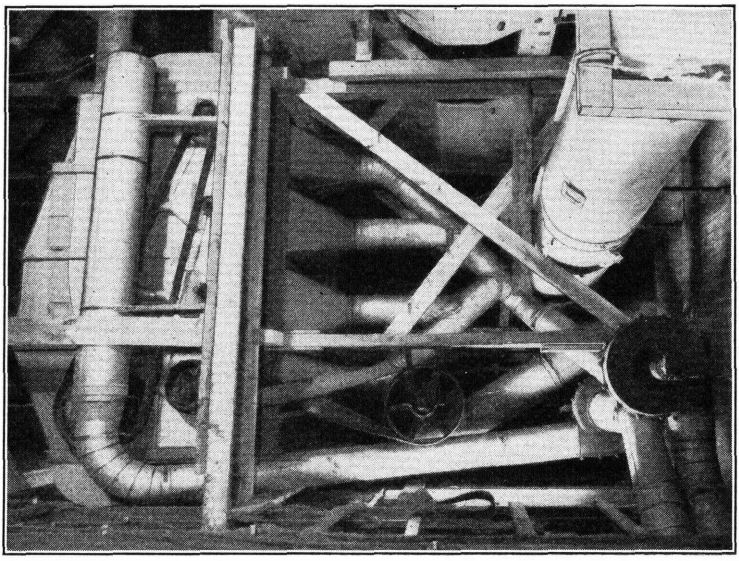

FIGURE 31.—Gin outfit in which hot air is applied to the cleaner at the ends and tops of paddle-wheel cylinders.

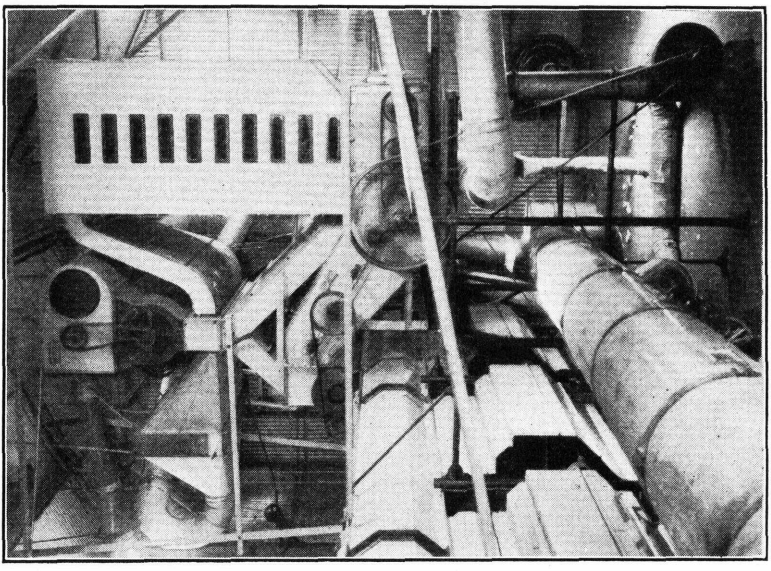

FIGURE 30.—Gin outfit with application of hot air to an overhead cleaner at top of drums.

and economy of operation. With the other systems, belt distributors are generally replaced by conveyor distributors. If there already is a conveyor distributor the additional units shown can be added conveniently, to make a very compact drying system.

Another method of combining cleaning and drying facilities economically is illustrated in figure 30. Like the drying system previously mentioned, this system may obtain heat from steam coils or engine waste heat.

A factory-built installation of an overhead paddle-wheel type of cleaner with a drying attachment on each side is shown in figure 31.

Figure 32 illustrates a comparatively new type of factory-built

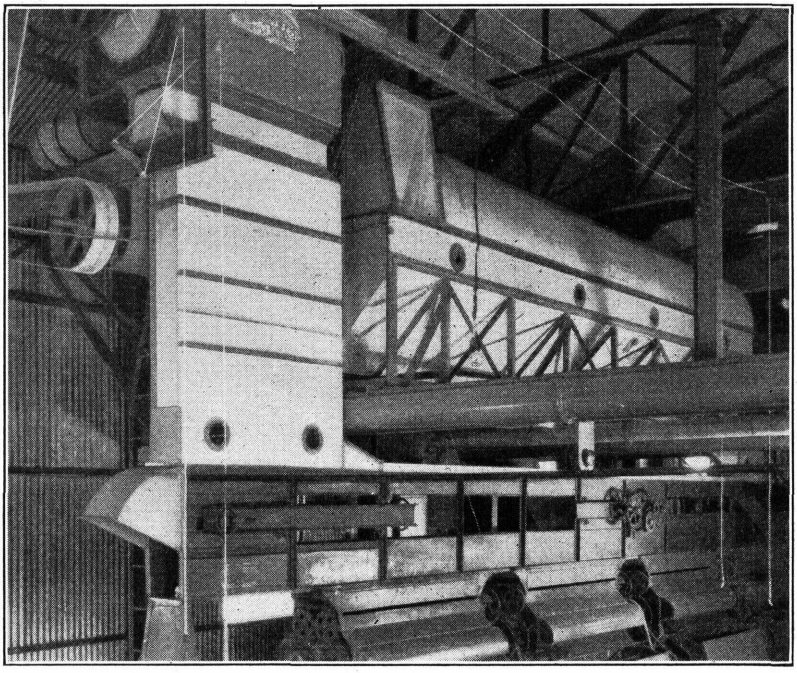

FIGURE 32.—Gin outfit equipped with a ribbon conveyor-cleaner drier.

drying system wherein the cotton is passed through a rotating screen cylinder with built-in ribbon conveyor, all in an encased chamber to which heat supplied by a hot-air furnace is introduced at various points.

Figure 33 shows an installation of the multiple-cylinder axial-flow air-line cleaner-drier which has been recently developed by a gin manufacturer. The steam coils are inside the cleaner.

A factory-built, revolving-floor, round vertical-tower drier is shown in figure 34. As may be seen in this picture of a commercial installation, the method of feeding the drier is similar to that employed in feeding some of the stationary-floor vertical-tower driers.

An economical method of applying hot air to air-line cleaners, as developed by the United States Cotton Ginning Laboratory, is shown in figure 35, in which is shown the split suction arrangement supplying

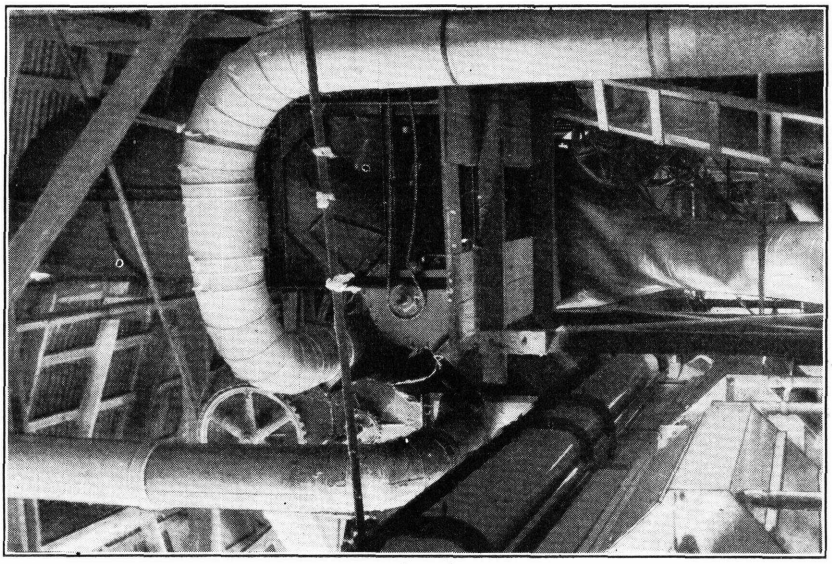

FIGURE 34.—Gin outfit equipped with a revolving-floor, vertical-cylinder drier.

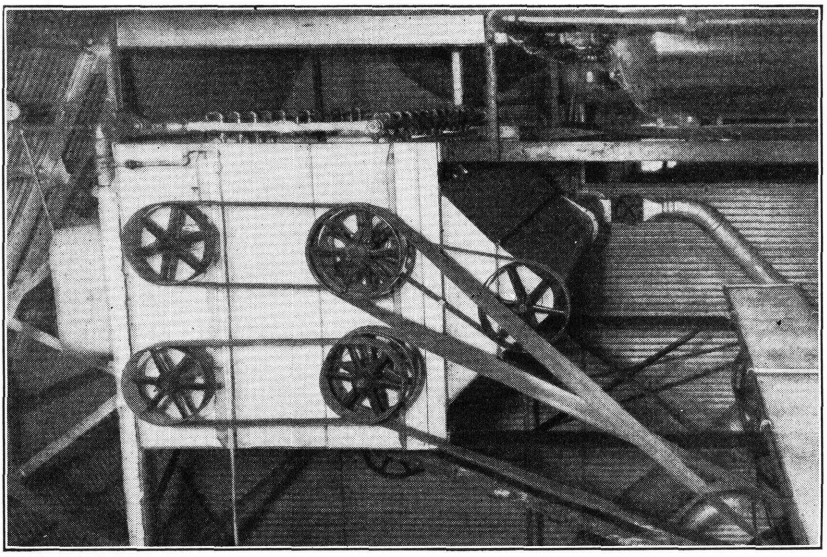

FIGURE 33.—A commercial installation of the multiple-cylinder axial-flow air-line cleaner-drier.

drying air and air for unloading the cotton from the wagon with one fan.

The tendency in recent years in regard to modernization of other units for preparing cotton further before ginning is the installation of unit extractor-feeders to replace the combined performance of more ponderous overhead cleaning machinery and gin-stand feeding equipment. Huller gins are likewise constantly replacing plain gins because they provide an additional cleaning action. Modern gin stands, now being made by all manufacturers, are of all-steel construction instead of wooden construction; and distributing systems of the belt and pneumatic types are gradually being superseded by all-steel conveyor and gyrator distributors. Interior views of an old-style gin outfit and a modern all-steel outfit are shown in figure 36. Thus the modern gin

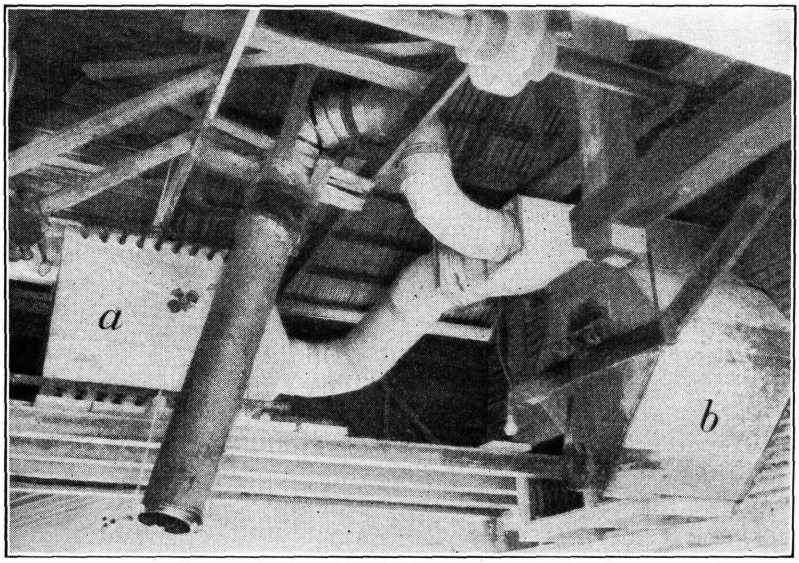

FIGURE 35.—Commercial installation of the Government-designed air-line drier: *a*, Heater coils and split-suction arrangement; *b*, drying chamber.

has an all-steel separator and conveyor-distributor instead of pneumatic elevators; unit extractor-feeders instead of cleaning feeders, huller instead of plain fronts; and a direct-connected drive and a minimum of belting instead of an independent saw-and-brush drive and many belts.

Modern gins generally have only one floor level, and the press as well as the condenser is of all-steel construction. The old-style wooden press and wooden condenser in a two-story gin and the modern all-steel down-packing press and steel condenser in a one-story gin are illustrated in figure 37.

Ginners are being urged to adopt efficient and economical means for handling seed at the gins. Provisions for handling cottonseed, including the methods of blowing and conveying, are brought out in figure 38.

Need for improvement in gin-building construction has long been recognized; and ginners are beginning to take advantage of the

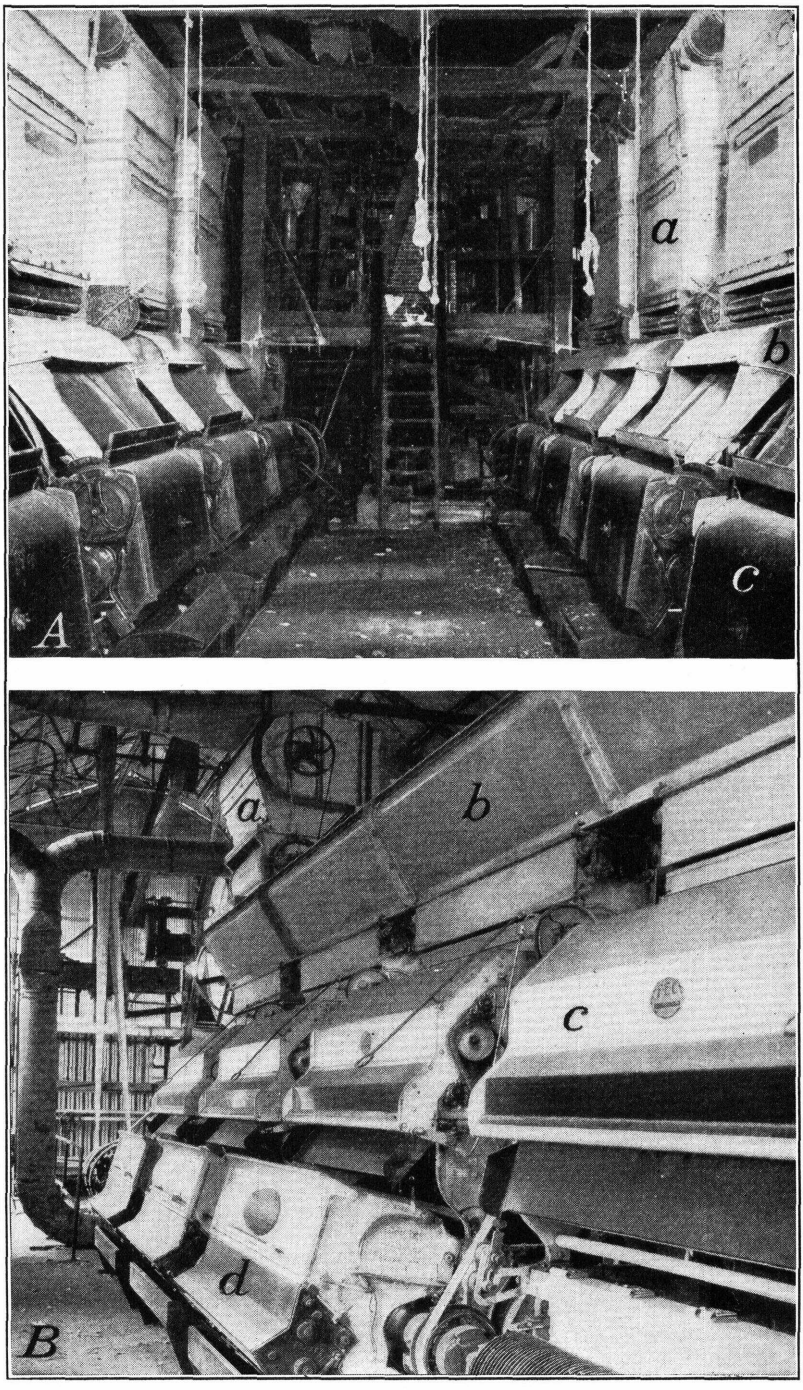

FIGURE 36.—*A*, Wooden gin equipped with pneumatic elevators (*a*), cleaning feeders (*b*), and plain fronts (*c*); *B*, all-steel gin equipped with separator (*a*), conveyor-distributor (*b*), extractor-feeders (*c*), and huller fronts (*d*).

opportunities in this direction. Typical old-time wooden and sheet-

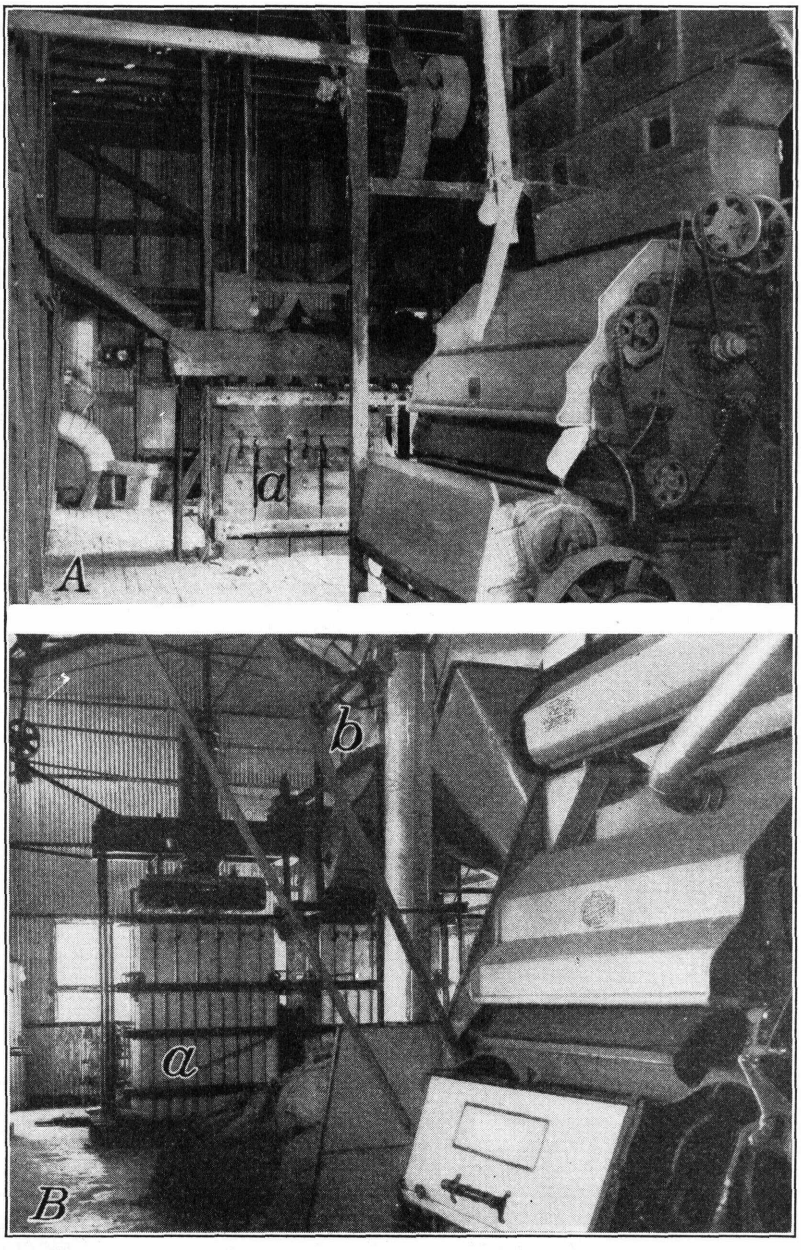

FIGURE 37.—*A*, Two-story gin showing (*a*) an old-style wooden press and a wooden condenser; *B*, one-story gin showing an all-steel down-packing press (*a*) and a steel condenser (*b*).

iron two-story gin buildings, in contrast with modern brick, tile, concrete, and steel buildings are shown in figures 39 and 40.

Progressive ginners find it profitable to have adequate and fireproof

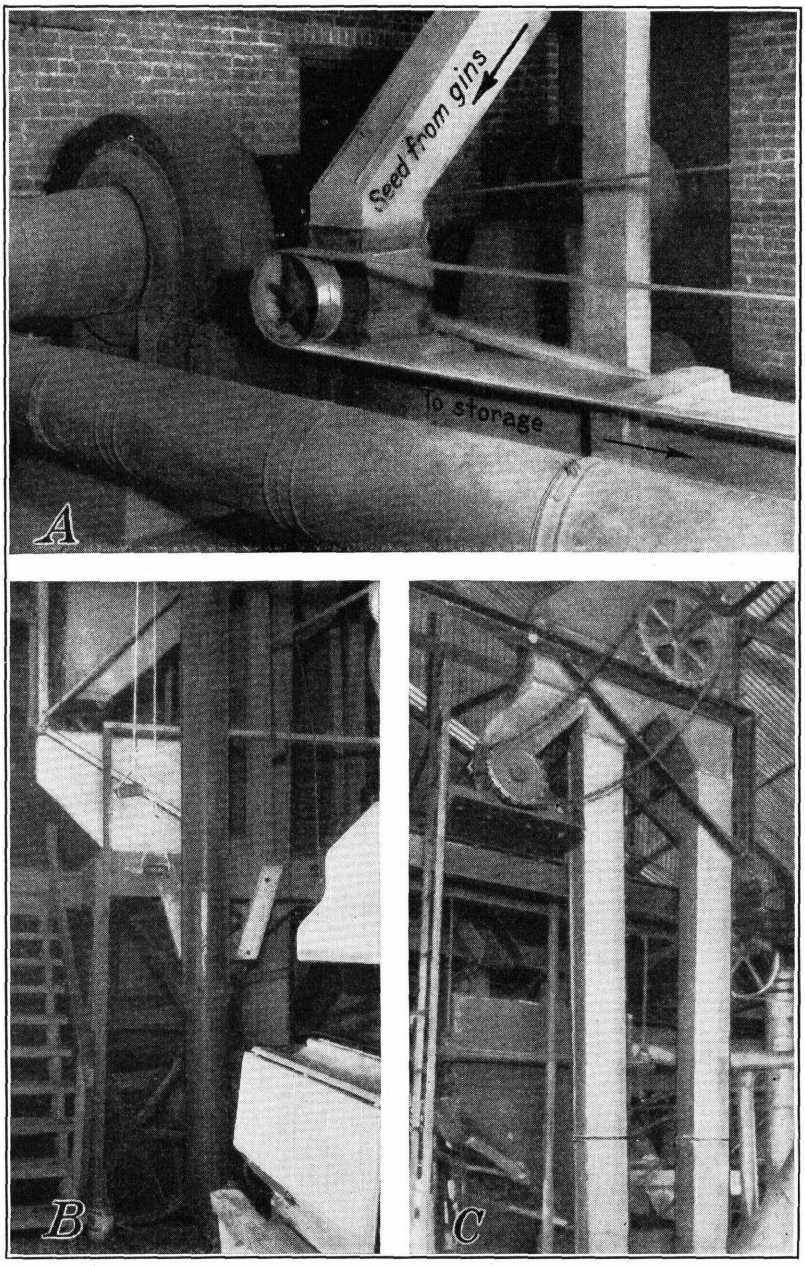

FIGURE 38.—Methods of seed handling: *A*, Seed blowing; *B*, elevating with vertical screw conveyor; *C*, elevating with bucket elevator.

facilities for storing seed cotton before ginning and equipment for handling the seed cotton with a minimum amount of labor. An

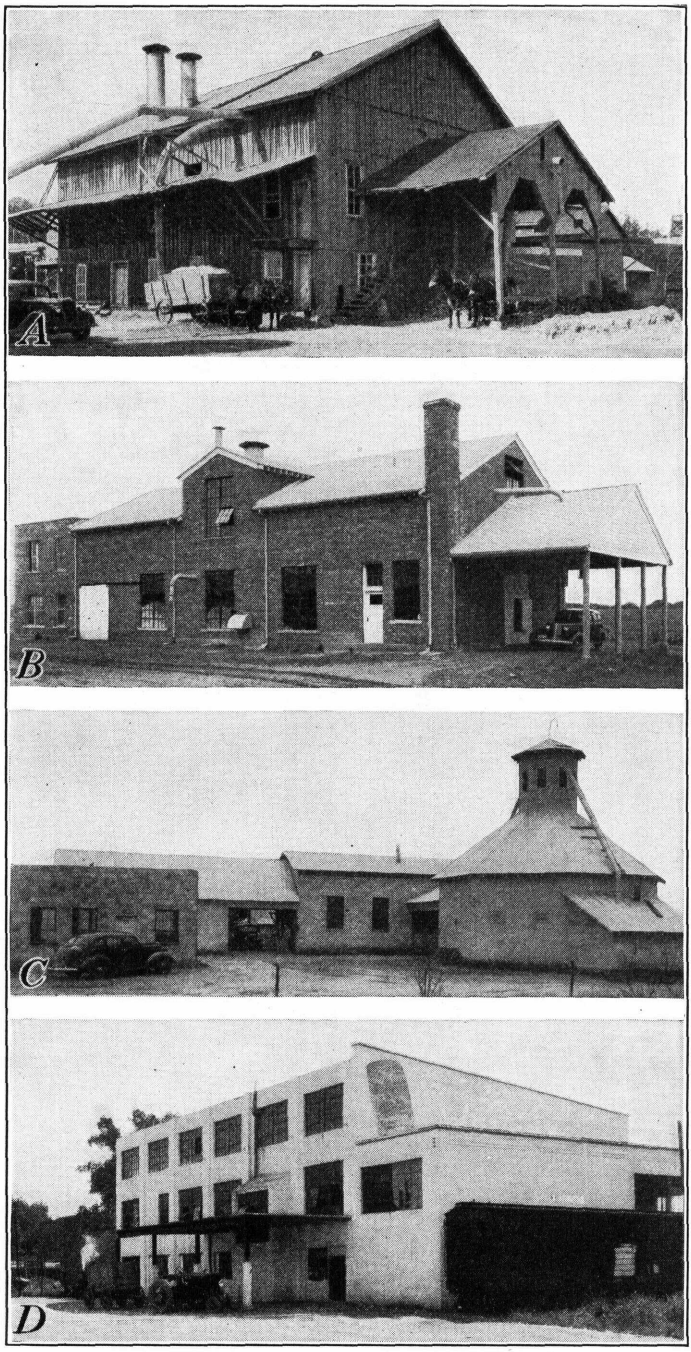

FIGURE 39.—Cotton-gin buildings: *A*, Old-type wooden construction; *B*, brick; *C*, hollow tile; *D* concrete.

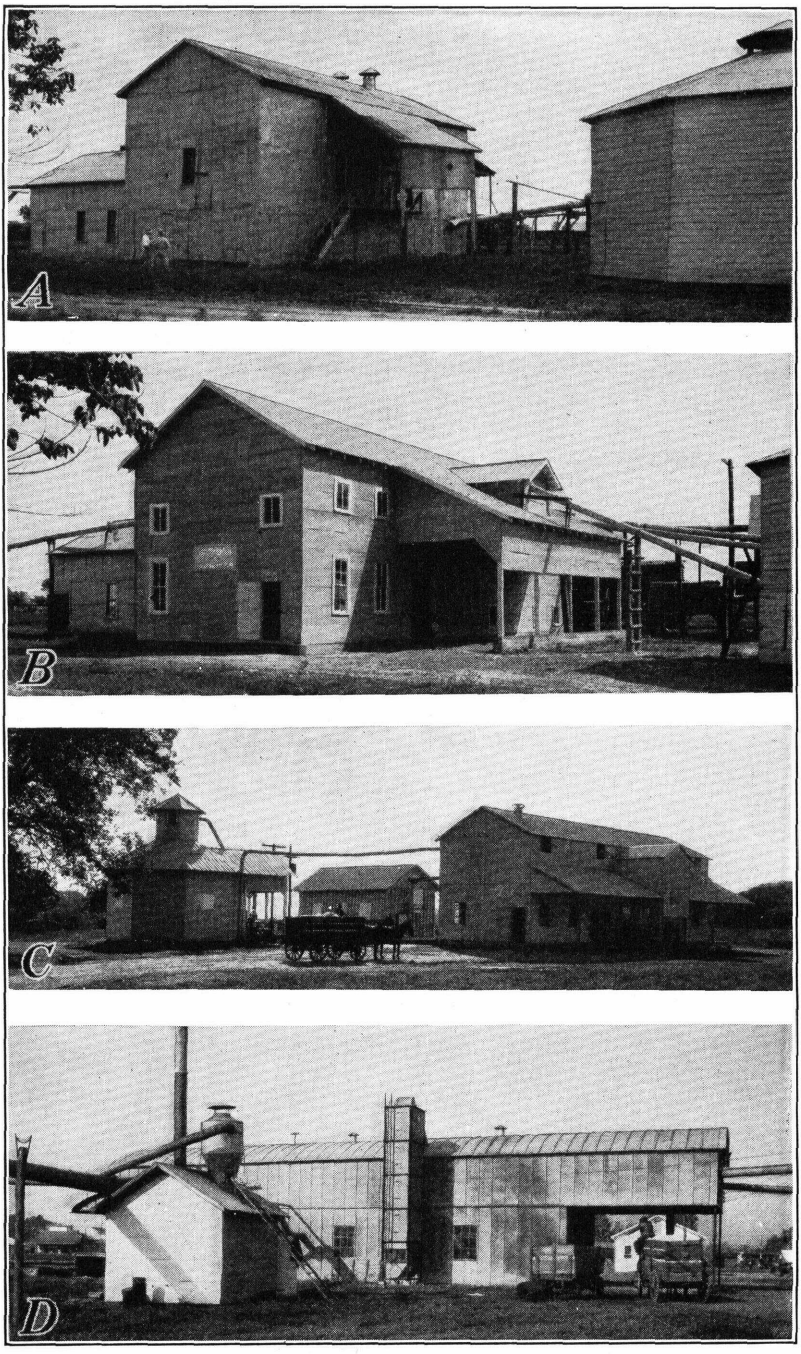

FIGURE 40.—Cotton-gin buildings: *A*, Old-type steel building; *B*, steel with wooden framing; *C*, all steel, inside and outside; *D*, all-steel inside and outside, with bow roof.

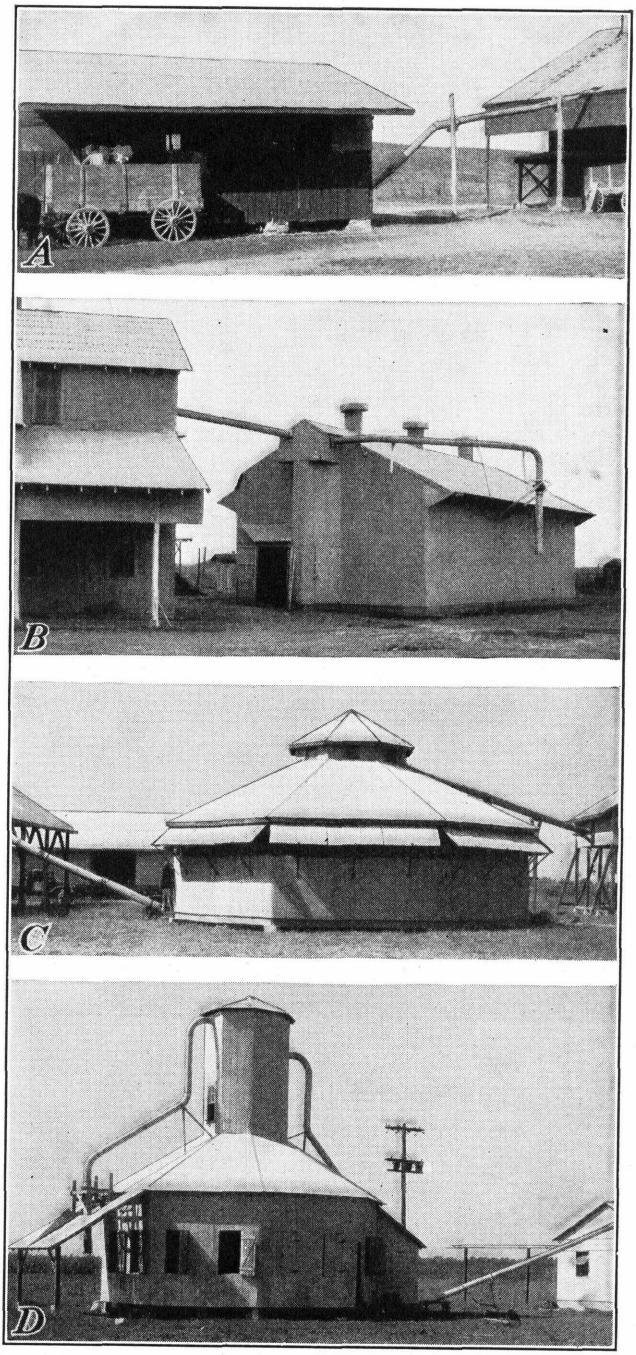

FIGURE 41.—Seed-cotton storage houses: *A*, Rectangular, without unloading facilities; *B*, rectangular, with Rembert-type fan for unloading; *C*, octagonal, with Rembert-type fan for unloading; *D*, octagonal, with pneumatic-dropper unloading system.

inadequately equipped old-style rectangular seed-cotton storage house, as compared with a modern octagonal sheet-metal house fitted with pneumatic unloading system and modern rectangular and octagonal houses equipped with a Rembert-fan assembly for unloading are illustrated in figure 41.

MAINTENANCE OF GINS

LUBRICATION

Good lubrication prolongs the life of the moving parts of cotton-ginning machinery, and the selection of the proper lubricants depends upon the use to which they are to be put.

The value of a lubricant depends upon its film-forming capacity at any operating temperature rather than upon its viscosity alone; hence oils of the highest viscosity are not necessarily the best lubricants. Selection of the lowest viscosity oil that will maintain an unbroken oil film on the bearing surfaces is usually best, because oils of greater viscosity consume more power than necessary in retaining the film and in overcoming the internal resistance of the oil itself. Likewise, the value of greases depends upon the pressures, speeds, and temperatures of the operating parts, as well as upon their body weight and apparent greasiness. Greases are usually more economical lubricants than oil. Other things to consider in lubrication are the location and types of the oil cups or grease plugs. Some bearings are not accessible for greasing or oiling except when the machine is idle and should be of an improved type that will hold enough lubricant to suffice for some time. Thus, bath or ring-oiling bearings are superior to plain friction ones because they have ample reservoirs and do not require constant attention. However, roller or ball bearings require still less attention, and the savings on power will usually more than pay for their installation.

The use of good grades of oils and greases saves money; loss of time due to break-downs and hot boxes is frequently caused by the use of inferior lubricants.

Lubrication charts are now generally available from most oil companies, to serve as a guide in the selection of oils and greases for various purposes. These usually indicate that shafting and machinery operating at normal temperatures and moderate speeds can use mineral oils with or without a low percentage of neutral animal or vegetable oils. In general, the heavier the machine, the slower the speed and the greater the viscosity recommended. For ball bearings and chain drives a rather thick oil or grease is necessary so that it will not run off. Generally, a No. 2 grease can be used for ball bearings wherever a light or medium oil is specified, and stiffer or high-temperature greases can be substituted for heavy or extra-heavy oil. For good operation, greases must have the same temperature ranges as the oils for which they are substituted. Bearings of the babbitt and sleeve type usually operate best with oils, while greases are preferable for ball and roller bearings for normal service up to 3,600 revolutions per minute. Periodic cleaning and renewal of lubricant are essential for all types of bearings.

High-speed sleeve bearings for motors require thin lubricating oils, and if the bearings are of ample size pure mineral oils may be used to advantage, but if the bearings tend to run hot, it may be necessary

to use a special lubricant that contains about 10 percent of "fixed" oil to minimize wear without increasing friction.

The quality and properties of most lubricating oils can be determined approximately without using any special testing apparatus. Impurities may be roughly detected by smearing a piece of writing paper with oil and holding it against the light; the blot will be equally transparent throughout if there are no impurities; otherwise solid particles will show. Another method is to dilute the oil with kerosene and then filter it through filter paper, which will catch any solids or impurities. To test for acids, some of the oil may be placed in a bottle and copper oxide added. If the oil retains its original color, it is free from acids, but if there are acids present the color will become greenish or bluish. Another simple test for acid is to drop some of the oil on a piece of clean bright sheet copper or sheet brass, and examine it a week later. There will be a green spot on the surface of the sheet if the oil contains acid. It is important to consult the manufacturers of the bearings of machinery if any doubt exists as to the best lubricant to use.

REPAIRING

The ginner should make preseason preparations for first-class operation, including cleaning and inspection, before he forgets the last season's troubles.

Certain operating and maintenance practices are vital from a ginner's standpoint. First among these is to have a clean gin, because it is profitable to the owner and tends to eliminate fire hazards and many mechanical troubles. At the beginning of the season and frequently thereafter the ginner should clean the plant, and it should be left clean when the last bale has left the press box.

The more important items to be checked over during the idle season are arranged here alphabetically:

Air-blast fan.
Air-blast nozzles.
Air-blast piping.
Bale boxes.
Bearings.
Belts.
Brushes.
Buildings.
Cleaners.
Clutches.
Condenser.
Conveyors.
Cotton piping.
Couplings.
Distributors.
Doffers.
Drives.
Electric grounding wires.
Elevators.
Engines.
Extractors.
Fans.
Feeders.
Fire extinguishers.
Flues.
Gears.
Greasing.
Idlers.
Lacing supplies.
Mote boards.
Motors.
Packing.
Picker rollers.
Press equipment.
Pulleys.
Pumps.
Rams.
Ribs.
Roof.
Saws.
Separators.
Telescope.
Tramper.
Trash screws.
V-belts.

An item that frequently causes trouble is the old-style distributor and its belt. Wooden gin buildings may settle or become warped. If the distributor braces are stiff arms straight to the walls, the distributor will often be pulled out of line and become a pair of snake-like boxes in which the upper box serpentines in one direction and the lower box in the reverse direction. Weight of cleaning machinery imposed upon the distributor may still further aggravate this twist and misalinement. These factors cause the paper pulleys to wear off on one part faster than elsewhere, the spikes of the belt in turn are ground off on the under side of the belts when the pulley grooves disappear, and the spikes may fall into the machinery.

Supports and fastenings of all overhead machinery should be kept tight. The cleaning screens in cleaners and extractors need checking. Screens too close to the cylinders may cause "machining" of the cotton, and, if too far away, they may cause "roping" and rolling. Extractor saws or teeth receive severe abuse from rocks, sticks, and foreign matter. These teeth should be realined and kept in good shape.

The feeding mechanism that governs the rate of feed into the stands may need adjustment, operating arms may be sprung, pinions on the "pancake" grid may be worn, or other repairs and replacements may be needed.

In the gin stands themselves, unless continual inspection is kept up, much may be overlooked. The saws must be sharpened as often as the work in any particular locality requires, which may range from once per every 100 bales to once per 400 bales per gin stand. By gumming and filing the factory pitch and the circularity of the saws must be retained as nearly as practicable. Factory pitch may be checked by using the gages or gin-saw segments furnished by the manufacturers, but if neither of these is available the leading edge of the saw tooth should be made to pass through the ribs parallel with the surface of the ribs or with the point of the tooth very slightly in advance. Unfortunately, much poor sharpening is being done in the field by persons who take no pains to maintain factory pitch or alinement or true-running saws. The best filing and gumming machines made are not automatic; it requires good horse sense to operate them and reasonable care in getting them started correctly. With either plain gummers or combined gumming and filing machines, the tooth is tapered on the sides so that the tip of the gin saw tooth is about one-half as thick as the saw disk or the base of the tooth. Department of Agriculture Circular 393, Care and Maintenance of Cotton-Gin Saws and Ribs, gives more information on the subject.

Ginning ribs may become so badly worn that seed will readily pass through the rib space or slot along with the lint and cause an undesirable addition of seed to the ginned lint. For efficient ginning, ribs should have clean, straight edges with the sharpness barely removed, and the saw slots should not vary more than 0.02 or 0.03 of an inch from the standard width. Repairs to gin ribs consist of (1) inserting new segments in a cutaway socket in the rib; (2) welding new material upon the worn spots to build up the rib, followed by grinding to correct dimension and shape; or (3) covering the worn surfaces with hardened plates of suitable width and minimum thickness to once more give well-defined edges to the ribs. Improper saw-rib relationship, which produces dragging of saws against the ribs in one or several stands of a gin plant interferes with the production of lint of uniform quality.

Defective brush cylinders or air-blast nozzles and their improper adjustments are sources of damage to the lint. If the bristles of the brush are so badly worn, or the brush is so shifted from its required relationship to the saws that effective doffing of the fibers from the saws of one or several of the stands is not obtained, some of the fibers engaged by the saw teeth will again be carried back through the outer rib and roll box, and thus cause nappy or poorly prepared lint, particularly with damp or wet cotton. Brushes should be protected from dampness, vermin,and rodents and should be refilled when necessary and then carefully balanced. Ball-bearing balancing rigs or knife-

edge balances may be home-made by the ginner if he is familiar with ways and means for such work. Heavy wear of brushes sometimes occurs when they mesh too deeply into the saws. If the entire brush assemblies are badly damaged, it is advisable to have them reconditioned at the factory or a repair shop.

Effects similar to those associated with poor-condition brushes are produced if an air-blast nozzle is restricted by an accumulation of foreign matter and rust. Also, these nozzles require periodic adjustment to provide adequate doffing of the lint from the saws. Air-blast nozzles should not only be given occasional inspection to insure correct position and freedom from chokage, but should also be tested with a U-tube water gage during the operation of the gin to maintain correct doffing pressure.

The adverse effects of defective doffing mechanism are intensified by obstructions in gin and lint flues, such as rust, and joints and rivets that accumulate cotton and adversely affect the doffing action of brushes and air blasts. Therefore, these flues as well as condenser drums should be kept clean and smooth to prevent backlash, which produces undesirable effects on the quality of the cotton.

Many dividing boards in brush gins are never touched from the day they leave the factory. This board divides the saws and brushes, and it is important that its proportions be maintained. Some manufacturers provide their patrons with inexpensive metal covers for this purpose. All operators of brush gins should give this board a close inspection and guard it against change in position or wear. When the board becomes worn, it changes the volume and direction of the brush blast upon the saws, and it may seriously affect both the doffing and the moting action. Likewise, the backboard or windboard, which is above the brush at the back of the gin stand, must be kept free from wear and sufficiently close to the brush tips so that "fly" and lint do not accumulate in wads above the brush.

Picker rollers should be checked for missing spikes and should be properly alined so that the spikes center between saws.

A contributing factor to vibration is the collection of lint and fly which will build up on fan blades, thus destroying the balance of the wheel and eventually becoming a menace to life and property. The wheels, blades, bearings, clearances, and speeds of fans should be carefully inspected to reduce hazards incident to their use.

Seed elevators and conveyors of the screw or helical flight require periodic attention to insure satisfactory operation.

Press rams should be properly packed at reasonable intervals and petroleum oils should be used as the hydraulic fluid instead of water. Although such oils involve a slight expense, they prevent corrosion and protect the polished plunger surfaces and the working parts of the pump.

Gland packing on the rams or plungers of presses should be given sufficient attention to avoid break-downs and leakages.

FIRE AND SAFETY PRECAUTIONS

Fire is a continual threat to cotton gins. This necessitates inspections of fire extinguishing apparatus and electric ground wiring. Information on this subject is given in Department of Agriculture Circular 76, Fires in Cotton Gins and How to Prevent Them.

Expenditures for the care of the buildings and premises to avoid roof leaks, protect the machinery, and lessen fire hazards by frequently removing all clinging lint and dust are a good investment.

The use of sight-feed oilers on plain bearings and the exercise of care in filling oil reservoirs on other types of bearings, in addition to effecting a saving in lubricants, will minimize the hazards of fire due to surplus oil that runs onto the floor and machines. Hot boxes cause gin fires and may be avoided by adequate lubrication of bearings.

Water barrels and fire extinguishers should be kept on hand at convenient points and should be inspected frequently to see that they are in good order, barrels full of water, and extinguisher properly charged. If the fire buckets are cone-shaped they are less likely to be carried off and cannot be set down by indolent employees when combatting a fire. Sacks and buckets should be within reach of the water barrels at all times for ready use.

In gins equipped with a boiler for power or conditioning, steam-smothering pipes may be attached to the distributor and lint flue. Patented extinguishers using carbon dioxide and other gases are also available.

Safety precautions should include the education of all employees in safety-first measures; the construction of sturdy guards to protect employees from moving machinery; and the posting of conspicuous signs prohibiting any one from attempting to remove chokages on the under side of gin ribs during operation. Much loss of life and limb is annually caused by saw cylinders catching the clothing or arms of employees when attempting to get under a gin stand while it is running. The wisdom of other precautions, such as preventing smoking, carrying of matches, and the keeping of an adequate force of labor on hand to meet fire emergencies is obvious. Cotton-house fires are common, and the same protection should be arranged for them as for the gin building.

If there is any likelihood of a fire existing within a cotton bale, it should be placed at once on the open lot at a safe distance from all buildings, wagons, and other cotton. Constant vigilance is the best precaution against fires, and clean premises will generally prevent fires caused by spontaneous combustion or carelessness.

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